ELECTRONICS Australia

HIFI NEWS

OCTOBER, 1975
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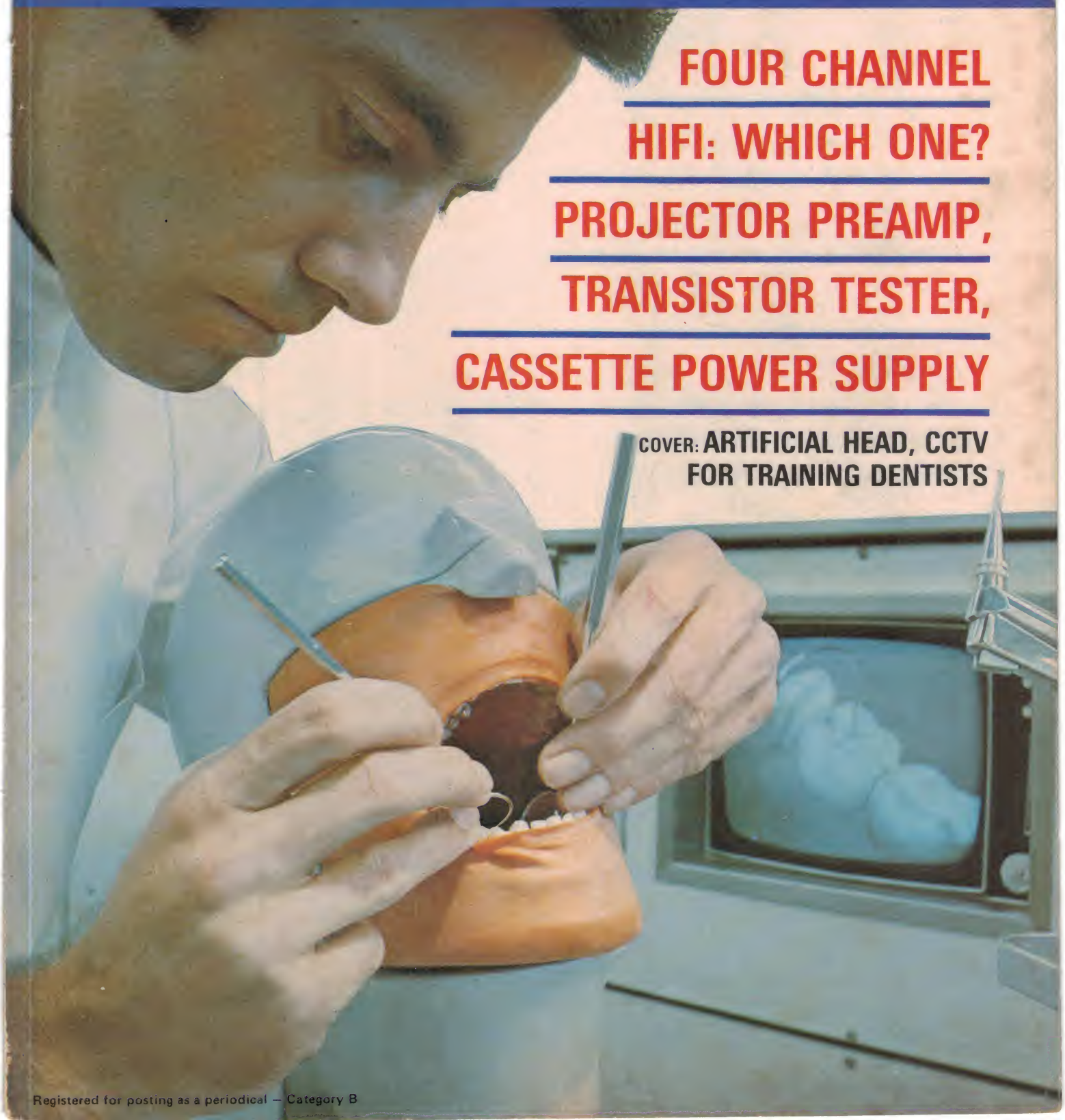

FOUR CHANNEL HIFI: WHICH ONE?

PROJECTOR PREAMP,

TRANSISTOR TESTER,

CASSETTE POWER SUPPLY

COVER: ARTIFICIAL HEAD, CCTV FOR TRAINING DENTISTS

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FOR THE TRULY SENSITIVE LISTENER...

SONY PS 5550 Photo-Sensitive Auto Return Turntable

(no mechanics means a smoother trip)

Sony ends the old argument about automatic versus manual turntables magnificently with the new PS 5550.

Now you can enjoy the convenience of automatic return without the wear and tear, noise and other problems usually involved in mechanical detection.

The Sony PS 5550 really is an electronic marvel. Not only is the automatic return detection operated by photo-electric means, the large D.C. motor is electronically speed controlled.

Sony's renowned engineering excellence shows throughout the brilliant PS 5550. Performance is nothing less than sensational with wow and flutter at an amazingly low under 0.08% (DIN 45539) and signal/noise better than 65dB (DIN 45539).

How does Sony do it?

Firstly, rotation is always stable and accurate because the large, slow-speed D.C. motor is servo controlled.

Every micro-fluctuation in current automatically generates its own correction so the speed of motor and platter never vary. Then the turntable mounting is shockproof, effectively insulating it from external vibrations, and even pushing the control buttons does not affect stability, because the controls and turntable sections are mounted on separate bases.

An illuminated stoboscope, with two vernier speed adjustment knobs, allows accurate control of pitch.

The tone-arm is a precisely engineered S type, statically balanced, with both direct-reading tracking-force gauge and anti-skate compensator. The headshell is the universal plug-in type. Operating controls are all neatly grouped in a strip on the front. They provide automatic set-down and arm return. Auto reject and manual operation is also provided.

Aesthetically, the PS 5550 is slim and beautifully simple. To sum it up, may we quote Australian Hi-Fi Test Laboratories: **'A superb turntable'**

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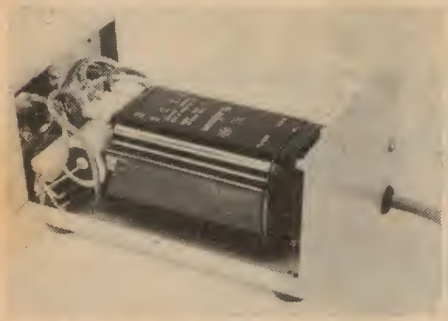
ELECTRONICS Australia

Australia's largest-selling electronics & hi-fi magazine

VOLUME 37 No 7

The TV set as a large print magazine—this is the concept behind the recently developed Ceefax and Oracle teledata transmission system. Our article on page 30 describes the workings of the teledata system, and discusses its capabilities.



Designed specifically for powering car cassette and cartridge tape players, this simple mains supply has a nominal 12V rating and can deliver up to 2A continuously. Constructional details on page 50.

On the cover

Something for budding dentists to cut their teeth on! This dummy set-up, now in use at the Medical School of the University of Utrecht, Holland, allows the lecturer to demonstrate techniques to students without inflicting pain on a real patient. The lecturer works on the "master mouth" in a studio situation, allowing a TV camera to get close ups of the action. The entire system was designed by Philips Vision and Sound. (Picture courtesy Philips Industries Ltd.)

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Editorial Viewpoint

Why nobble the Novice?

When the Postmaster-General announced the introduction of a Novice Amateur Radio Station licence earlier this year, there was no indication given that the licence would be of only limited tenure. This implied that the new licence would form a permanent third and lowest tier to the existing licence structure, to cater for those unable or unwilling to meet the higher licence requirements.

This seemed a sensible and realistic move. From the evidence provided by illegal "citizens' band" activity, it is obvious that there are a lot of people who enjoy using two-way radio gear at a level involving very modest technical background and expertise. By providing a new amateur licence with minimum-standard requirements, hopefully quite a large proportion of these people could be encouraged to "go legal", and enjoy their hobby legitimately and with minimum interference to other users.

However it has now become apparent that the PMG's Department intends to place a 2 year limit on tenure of the Novice licence. In other words, holders of the licence are not going to be allowed to sit back and enjoy their modest privileges. The bureaucratic machine is taking upon itself the authority to "encourage" them—or more accurately, force them—into meeting the higher licence requirements.

The Novice licence is thus going to be a will-o'-the-wisp, with no real status at all. It is obviously seen by officialdom as only a passport to possession of a "real" amateur licence. If the journey is not completed in the stipulated time, it is designed to self-destruct like Cinderella's ballgown.

One can only speculate as to why officialdom cannot accept that Novice level activities could be legitimate in their own right. Frankly, I am inclined to suspect that the Wireless Institute is responsible for the 2-year limitation. It is well known that there is a vocal and highly reactionary pressure group within the WIA who have never accepted even Limited licensees as "real" amateurs, and the 2-year limit is just the sort of Colonel Blimp attitude this group would adopt.

For potential Novice licensees, the 2-year limit will surely lower the appeal of the licence significantly. If you're already enjoying the pleasures of radio communication illegally on 27MHz, what's the point of going legal if you can only do so for two years?

And as far as the department itself is concerned, the main effect of the 2-year limit will be to increase the required administration.

It seems to me incredibly ironic that the Novice licence is to be emasculated in this way. Perhaps it would have a kind of narrow-minded logic if the department saw the purpose of a "full" amateur licence as being to perform responsible experiments and amateur research. But it is quite clear from the Assistant Secretary's letter we reproduce on page 85 this month that they don't. By permitting operation only in rigidly defined specific ways, they reveal that amateur radio is seen only as "playing around with radio".

If you share my misgivings, why not write to the PMG or the WIA, or both?

Jamieson Rowe

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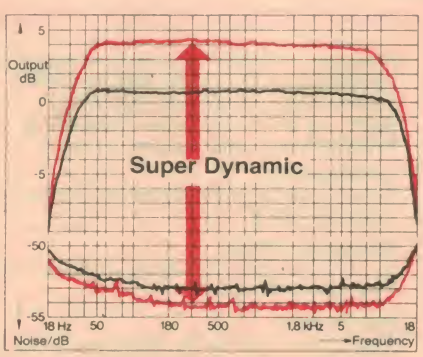

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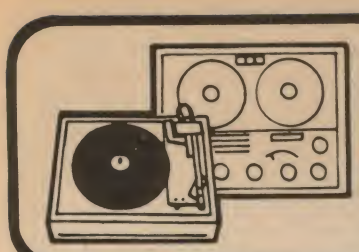

Hi Fi News

QUADRAPHONIC—BUT WHICH SYSTEM?

by NEVILLE WILLIAMS

When browsing through record displays, it is not unusual to come across albums marked "4-channel" or "quadraphonic", but with no hint as to the matrix encoding systems which have been used in their production. To a technically orientated person it seems incredible that the manufacturer could have been so negligent as to omit this vital piece of information from the label and jacket.

Those with 4-channel facilities may have made a further puzzling observation: some apparently routine 2-channel stereo discs respond so impressively to decoding that one may wonder what coincidence of stereo mixing has given them this surprising quality.

While some such observations may be explained by "negligence" or "coincidence", it would appear that they could be accounted for more logically—and more frequently—by deliberate marketing decisions.

Just how marketing pressures can operate is perhaps best illustrated in a company which happens to have the least involvement in conventional matrix technology: RCA, one of the sponsors of the rival CD-4 "discrete" system.

When RCA launched its CD-4 quadradiscs, it was keen to protect itself and retailers against having to stock the same title in separate formats, needlessly increasing stock inventory. RCA said that its existing "stereo" catalog would continue as such; its quadradiscs would be new titles, releasing only in CD-4. They would be marketed as compatible—capable of being played as ordinary stereo recordings; the same discs would therefore meet both needs.

It was an enterprising and logical plan, with just one failing: it didn't work!

What is better than a pair of ear muffs to shut out the noise in industrial situations? The answer, according to AWA Rediffusion, is ear muffs in the form of headphones which can simultaneously provide the wearer with communication facilities and selected background music. There are no trailing cords; an induction loop around the problem area radiates signal directly into the phones, which have an in-built volume control. The music and speech overcomes the diffidence that many operators have for conventional ear defenders, most preferring the discomfort and hazard of industrial noise to isolation. The new AWA Rediffusion units offer as good, if not better, noise protection than conventional muffs, with the added advantage of background music.

RCA found that record buyers as a group failed to heed the publicity, tending rather to leave the CD-4 discs for those that owned CD-4 decoders. Retailers compounded the problem by giving CD-4 discs their own special display—attracting one group of buyers for certain, but discouraging just about everyone else!

RCA finally had to accept the fact that they were losing sales of records which buyers wanted but could not find in "stereo". As a result, the company had to perform an about-face and begin issuing "stereo" versions of some quadradiscs.

Perhaps less obviously, buyer reactions have also affected company attitudes to the marketing of matrix encoded quadraphonic discs. Despite all the publicity and the jacket notes about compatibility, "stereo" buyers are still cautious about matrixed 4-channel records, and the lack of a particular title in ordinary stereo can limit sales.

Even among deliberate 4-channel buyers, emphasis on the decoding method can polarise the major groups—SQ, QS, RM, etc—or simply cause uncertainty, again with an inhibiting effect. The question therefore arises as to whether decoding information will help or hinder sales, perhaps to the point of determining the profit or loss on particular albums.

Where they are not strongly committed therefore, record manufacturers are tending to take a soft line. They know that the majority of record buyers are less concerned about the subtle aspects of decoding than engineers and hifi buffs. If the sound is clean and disperses to fill the listening room convincingly, that is all that most listeners expect. They have no way of knowing—even if they cared—whether the dispersion is as the producer intended.

In short, there is a strong temptation for record manufacturers simply to mark the sleeve "4-channel" or "quadraphonic", omitting any reference to the encoding system. If the omission irks the technically informed, it equally makes life simpler for retailers and that large body of record buyers who are deterred rather than stimulated by technical detail.

In fact, it would seem that the attitude of record buyers and companies varies from one country to another.

Japan is system conscious, with CD-4 discrete and the various matrix formats all making their bid for identity. This awareness provides an incentive for record manufacturers to mark their products appropriately.

In Germany, too, there is a tendency to display the encoding method fairly prominently.

By way of contrast, interest in quadraphonic systems in France is much lower, as also is the demand for quadraphonic records. The vast majority of records sold on the French market are

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therefore branded "stereo" and Frenchmen buy them as such. The curious fact is that a proportion of them are really matrix quadraphonic pressings, sometimes distinguishable as such by a suffix on the stamper number in the vinyl just outside the label.

In the UK, America and Australia, the situation lies somewhere between these two extremes. There is a significant demand for 4-channel records but without an insistence upon encoding information from buyers at large. Depending on the source of the original recording, the information that comes with it, the program content and the attitude of the local distributor, the encoding information may be emphasised, played down, or omitted altogether!

How all these factors can interact was amply illustrated by an album which recently came to the attention of one of our record reviewers.

The master, which came from overseas, had been encoded for quadraphonic but the local distributor was uncertain whether it ought to be released as such or in a simple "stereo" jacket. Either way it sounded just fine and the first inclination was to label it "stereo".

The marketing people realised, however, that it would be just one more album of its type on the already well stocked stereo shelves. Displayed as a quadraphonic, it would probably stand a better chance.

So to our reviewer's specific question: How was it encoded?

The company didn't know and were not particularly concerned to find out. It would sound okay on any likely system and that was the thing that mattered. To brand it with a particular code would put off more prospective buyers than it would attract!

Had the company followed the first inclination and released the album as "stereo", it would have been just one more album that, mysteriously, responded so well to matrix decoding!

Or, to borrow a phrase from overseas journals: just one more "underground SQ"! Or should it be "underground quad"?

What about these underground pressings? Is the buyer being duped? The answer would be yes, if it could be established that typical quadraphonic discs, played in 2-channel mode, were automatically and consistently poorer than their genuine 2-channel counterparts. There seems to be no body of opinion to support this, however, at least in respect to popular music. On the contrary, the sentiment seems to be that they are "at least as good as . . ."

How one reacts to all this is a matter for the individual. If you're an engineering purist, you'll be horrified. If you're cast in the mold of Sherlock Holmes, you'll find it a challenge. If you simply want to enjoy what's dispensed from the record shops, you'll play and enjoy each album the way it sounds best.

Incidentally, one of the Enoch Light quadraphonics which came through recently without qualification, yielded to the Sherlock Holmes approach. Examination of the die number in the vinyl turned up two significant letters: "SQ"!

SUPER BASS: While most modern hifi loudspeaker systems can produce a level of bass output sufficient to satisfy the average enthusiast, the truth of the matter is that their radiated energy diminishes rapidly below 80Hz, with output below about 50Hz being notably weak. Even many of the larger systems exhibit the same failing, being scaled up in power handling capacity rather than overall response.

One effective way to disguise a supplementary "super-bass" loudspeaker for hifi systems or organs, is to make it look like a free-standing occasional table and use it as such. As mentioned in the text, this American unit houses a 16-in driver radiating upwards and outwards through a grille beneath the edge of the table top.

AUDIOSOUND AMPLIFIERS FOR THE ABC

Audiosound Electronic Services report that they are currently making deliveries under a contract to the Australian Broadcasting Commission for supply of more than 150 stereo monitoring amplifiers to be used throughout the country.

Designated A750M, these stereo amplifiers have inputs for 600 ohm balanced lines via Cannon XLP connectors as well as the normal phono and DIN connectors for tape and record playing equipment. Power rating is 20 watts RMS per channel. The amplifiers are to be used in ABC offices throughout Australia for program monitoring and evaluation.

A domestic version of the amplifier, designated A750D, will be released shortly. It will be available as a separate unit or as part of a complete Audiosound stereo system retailing at under $400.00.

Further information can be obtained from Audiosound Electronic Services, 148 Pitt Road, North Curl Curl, NSW 2099.

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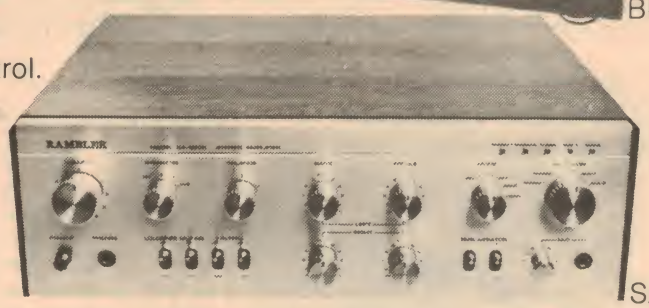

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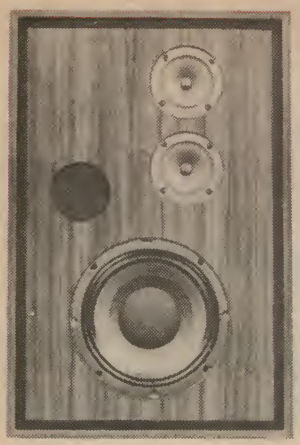


PLESSEY SPEAKER SYSTEMS

Pictured above are two new loudspeaker systems which have recently been announced by Plessey Australia Pty Ltd. At the top right is the PE1000, a bass reflex design of nominal 50-litre capacity. It uses a C100 bass driver, a KC3DX upper mid-range, and an X20 horn tweeter to give a nominal power handling capacity of 20W RMS or 40W "program". Claimed response is from 40Hz to 30kHz, although the manufacturer's own published curve suggests that these figures are optimistic. For those in the market for a more compact system, the PE800 (top left) is a 37-litre bass reflex enclosure with a C80 bass driver and two KC3DX tweeters. The power rating is the same as for the PE1000 but, because the sensitivity is 92dBSL/W instead of 94, the actual level from the smaller unit for the same drive would be slightly less. Again, judged on the manufacturer's curve, the response of the PE800 is rather more lumpy than the larger unit but the bass end would appear to be comparable. Both systems present a nominal 8 ohms impedance, both have a hand-rubbed American walnut finish and a moulded polyurethane grille. (Details from Plessey Australia Pty Ltd, Components Division, The Boulevarde, Richmond, Vic 3121.)

Some enthusiasts have sought to overcome the problem by providing a "super bass" channel—a specially designed loudspeaker system, often with its own separate driver amplifier, intended to handle frequencies only below 100Hz. Superficially, such an add-on system adds little to the program and many would consider that the complication is unwarranted. However, perceptive listeners note and appreciate the more subtle profundity of the extra octave of bass which, when present in the program material, is felt rather than heard.

In the May issue of "Electronics Australia", Bernard Simpson described the construction of a super-bass loudspeaker system, in the form of a tapered column which could be attached to a suitable wall surface—hopefully without taking up too much useful space in the room. It could be built as a stereo pair or as a single system fed with a bass signal derived from the two channels.

The problem with super bass loudspeaker systems is that, by nature, they tend to be bulky and this is true of virtually all the units which are on sale at hifi shops in the USA, notably those serving the top end of the market.

However, writing in "Audio" magazine recently, Bert Whyte refers to a super bass system which has been developed by John Marovskis, President of the New York Audio Society. The system enclosure measures 22 inches square and 18 inches high, being styled in such a way that it could double as an occasional table. The top is quite plain and the 15-inch theatre woofer with 4-inch voice coil radiates through what looks like a decorative frieze between the underside of the top and the four sides.

The 15-inch loudspeaker radiates upwards, into a contoured chamber, and thence through the grille into the room. Bert Whyte says "after living with this unit for a number of months, it is hard to believe that this small system has been pouring out some of the deepest, cleanest, most awesomely sonorous bass frequencies I have ever heard".

It is an interesting challenge and one can imagine dedicated hifi enthusiasts eyeing the occasional table which currently sits useless in their living room, supporting a vase of flowers or an ornament. Perhaps it could be replaced by a suitably styled enclosure that could still support the ornament or the coffee cups! But tucked away inside would be that 15-inch speaker that they've always wanted to use . . .

"PIRATE" RECORDINGS: Following publicity given to the rip-off in USA and Japan from "pirate" recordings, sold without regard for royalties or copyright, the lid has been lifted off the situation in Australia. Whether it will stay off is, of course, another matter.

Typical of articles in the daily press, a reporter from the "Sydney Morning Herald" confirmed that pirate cassettes were selling freely throughout Australia in "milk bars, small bargain stores and jewellery shops". He quoted the example of a gift shop in Sydney where scores of cassettes were being sold at $3.20 each featuring such artists as Tom Jones, Nana Mouskouri and The Beatles.

From the same shop he bought a double play cassette "An evening with John Denver" for less than half the recommended retail price of $9.99.

Confronted later by an executive of RCA, the company to which John Denver is under contract, the attendant admitted freely that the cassettes on display were pirate products. Presumably someone had decided the proposition was "worth a go".

Industry representatives told the Herald reporter that pirate recordings were coming into Australia in increasingly large numbers from Singapore, Hong Kong, Fiji, USA and Britain. Most are dubbings from the genuine commercial product but some are "bootleg" copies made at live performances—a practice which usually results in a very inferior product because of the acoustic environment and contrived microphone placement.

The John Denver cassette carried the initials "NB" which is apparently the trade mark of Nam Brothers, an Asian company very active in the pre-recorded cassette field.

Sequel to the initial publicity was a raid by Australian police on shops and a warehouse in Manly, Dee Why and Sydney's eastern suburbs during which 9000 cassettes were seized and impounded pending possible court action for each breach of copyright and infringement of trade marks. Since then, cassettes have been seized in other states.

The raids and the threat of court action may not stop the open sale of pirate recordings in Australia but it will certainly make the vendors think twice about stocking them!

A different approach to sound reproduction:

BINAURAL MICS. AND HEADPHONES

by NEVILLE WILLIAMS

While some hifi enthusiasts go to extreme lengths to achieve the ultimate 2-channel stereo reproduction, and others opt for ''surround'' sound, yet another group is getting involved, these days, in ''binaural'' sound. This is the group which talks about dummy heads, microphones which you wear, and ''Open-Aire'' headphones.

The word "binaural" was used very widely in the early days of multi-channel recording even though, in many cases, it was used inappropriately.

In its traditional technical sense, "binaural" implies the effective use of two ears, as distinct from one, usually in the context of determining the direction from which sounds arrive.

People with normal, reasonably balanced hearing use their binaural capability all of the time and quite unconsciously. In fact, it is this very ability which, earlier, highlighted the limitations of conventional single-channel sound reproduction. Listeners identified the source of the sound too accurately with the loudspeaker, leading to the expression: "listening to an orchestra through a hole in the wall"!

It was for this reason that enthusiasts of the era experimented a lot with multiple loudspeakers, bouncing sound off reflective surfaces, and with listening rooms having a certain deliberate amount of "liveness"—all intended to limit their ears' ability to pinpoint the source of sound.

In a two-channel system, sounds are radiated from independent loudspeakers, placed a few feet apart, in front of the listening position. The signals differ in amplitude and phase and these differences, interacting with the listener's binaural capability, can create the illusion of a sound source (or multiple sound sources) located anywhere between the two loudspeaker systems.

As before, both ears are used to listen to the total sound and it is therefore something of a misnomer to refer to single-channel sound as "monaural" and two-channel sound as "binaural".

After a period of argument and uncertainty, the terms "monophonic" (or "mono") and "stereophonic" (or "stereo") were accepted as applying respectively to single-channel and two-channel technology. In much the same way "quadraphonic" (or "quad") emerged as the appropriate term for 4-channel.

While 2-channel stereo has a marked advantage over mono, it has not been without its critics.

Some point out that, while stereo can certainly spread the source of sound, it projects the total sound from a line drawn between the loudspeakers—as it were, from a long slot in the wall rather than a single hole! But, with all of the sound coming from the front, 2-channel stereo cannot produce the effect of the listener being "enveloped", as in the original environment.

A further point is that the ultimate stereo image depends on rather arbitrary factors such as placement of the original microphones, judgment of the panel operator(s), placement of the loudspeakers and the nature of the listening room. The stereo effect may be convincing, even pleasing, but it may be far removed from the sound pattern that would be heard by a listener in a typical seat at the original performance.

At this point opinions divide. The majority of music lovers regard conventional 2-channel stereo as normal, adequate and practical. They hand-pick their records and tapes, buy the best equipment they can afford, and hopefully install it in a listening room large enough to generate its own quota of "surround" reverberation.

Some go a step further and opt for quadraphonic equipment of one type or another in an effort to reconstitute something of the original environment.

Others? Well, they tend to discard loudspeakers altogether and retire into a world of domestic isolation, dominated by a pair of high fidelity headphones!

There is no listening room to add to, or subtract from, the recorded signal. And the sound is no longer out front; it is all around them, with a presence that not only drowns out,

Two 7-inch 45 rpm records issued by Sennheiser to demonstrate their "Triaxial" approach. We felt that the first record was the better planned of the two but, unfortunately, it appears no longer to be available. The second record (front) contains sound scenes at an airport, railway station, in a phone box, near a swimming pool, and two music groups. It is available from Messrs. R. H. Cunningham (493-499 Victoria St, West Melbourne) for $2.00. Our reaction to both records is that they do not produce an obvious out-front sensation, sounds seeming rather to be confined to the left-rear-right sector.

but also shuts out all awareness of the immediate environment.

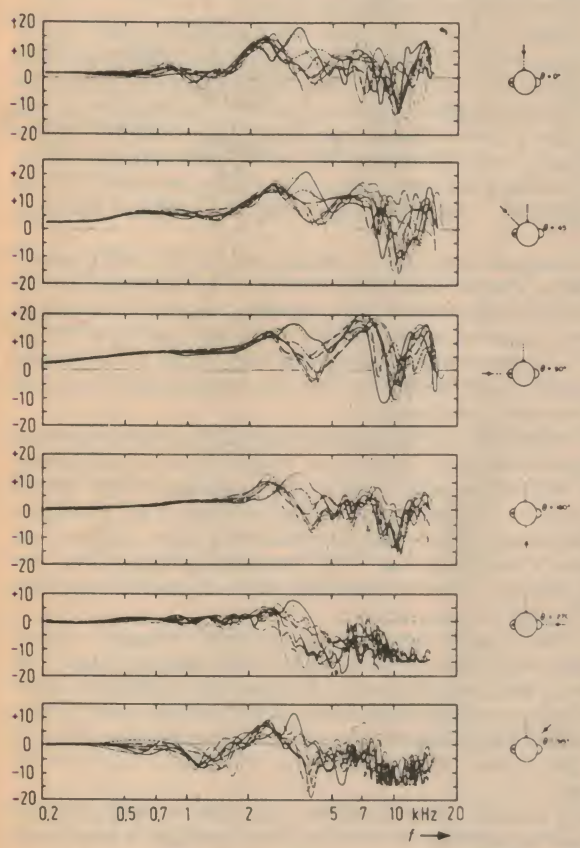
At times, headphones are convenient; at other times they are unsociable. But one thing is certain: with a good recording, they can provide a real sonic impact.

However, mere sonic impact is not the name of the game for some dedicated enthusiasts. They are aware that, in the ordinary way, earphones feed to individual ears sounds that have been recorded and mixed on the assumption that they will both be heard by both ears via a pair of loudspeakers. Separation between channels may be exaggerated or inappropriate on this account. In the worst case, the mixture of technology could approximate to a hypothetical listener, close up to the orchestra, with a head twenty feet wide, and with several ears on each side!

It leads to the question of how a recording should be made if it is to be listened to expressly and only on stereo headphones. Seemingly, it would involve placing two microphones so that they approximate the position of two ears belonging to a listener in a suitable seat in the auditorium. By means of a recording, these sounds would ultimately be fed to the listener's own ears, hopefully recreating the original sound environment for that listener.

This is the approach which has come to be identified by the term "binaural" and it represents precisely the opposite concept to stereo. Instead of trying to recreate the original sound field in the listening room (stereo), it attempts to transport the listener to the original environment by preserving the two discrete signals which his respective ears would have received, had he been present.

The company that is, perhaps, currently most involved with binaural technology is Sennheiser Electronic, represented in Australia by R. H. Cunningham Pty. Ltd., of 493-9 Victoria St,



A family of sound pressure curves plotted at the ear inlet of ten different people for six different directions relative to the head. While not meant to be read individually, the curves do emphasise the spread of response due to differing head contours. The curves suggest why an individual may misinterpret a binaural recording made using a dummy head or with stereo mics worn by someone else.

BINAURAL MICS, HEADPHONES

West Melbourne. Their efforts have concentrated in the two key areas: microphones and headphones.

It was estabished, early in their investigations, that it was not satisfactory merely to position any two microphones where a listener's ears might be in the concert hall. It was necessary to consider the nature and shape of the microphones, and also to have something between them to simulate a human head, with its inevitable spatial effects on response and phase.

In the course of time, microphones attached to a sphere gave place to progressively closer approximations of the real thing. The present "ultimate" is a head with hair, a surface texture similar to flesh, and microphones positioned in ears designed to interact with acoustic waveforms like normal human ears. For good measure it can be stood on its carrying case, to simulate the human shoulders and torso.

However, it would seem that even this "ultimate" dummy head has run into some equally ultimate—and practical—difficulties. The first and obvious one is that there are not too many situations where it can even be used. If ordinary microphones are variously intrusive, off-putting, or legally dubious, a full dummy head, staring fixedly and blandly at the performer(s), must be far more so!

A further problem is that, while a dummy head may have average characteristics, it could be as wrong for any given individual as an "average" suit of clothes. Supplied with signals obtained using a dummy head, individuals can be expected to misinterpret the information about direction to a greater or lesser extent, depending on the external differences between the dummy head and their own.

In an effort to overcome both these problems, Sennheiser developed a stereo microphone (model MKE 2002) intended to be worn on the user's own head like a pair of lightweight phones. The microphone elements rest in the respective ears and pick up a sound closely approximating what the wearer would hear by natural means. The unit is also relatively unobtrusive. Fed into a recorder, the sound can be reproduced later by headphones, hopefully recreating the original environment.

The accompanying Fig. 1, made with an MK 2002 stereo microphone, clearly depicts the influence of head contour on what each individual hears and considers "normal". It is a pen-plot of the response with ten different people and six different positions for the sound source. The curves are not intended to be studied individually but they do indicate the spread of spatial frequency response.

At the other end of the reproduction chain, Sennheiser have developed what they refer to as "Open-Aire" headphones, in three different models. These are designed to be light in weight and to couple sound to the listener's ears through a pad of soft foam, rather than by means of a large airtight muff. Sennheiser's theme is that, if the wearer can forget they are wearing phones, they will tend the more to identify with the original sound environment.

All this adds up to Sennheiser's so-called "triaxial" system, as an option from the more common stereo and quadraphonic methods of listening. "Triaxial"? Because the promoters claim that, by using just two channels to bring remote sonic sensations to the listener's separate ears, it is possible for them to judge the three vital directions: left/right; back/front; up/down.

To help convince the doubters, Sennheiser have released two 7-inch recordings, of which only the second is now available, distinguished by a prominent "II". The discs carry a number of sound scenes in which direction is highlighted and meant to be listened to on hifi headphones.

What do these and other such recordings demonstrate?

First off, they can provide an unusual listening experience to anyone hearing them for the first time. However, they do not resolve beyond doubt some of the queries raised about

the binaural approach.

Critics claim, for example, that the ears, in themselves, are not really as resourceful as sometimes represented. While capable of differentiating easily between left and right, there can be considerable ambiguity between front and back, and even between above and below. In ordinary listening situations, the ambiguity is resolved automatically by visual or other clues. Where these are not sufficient, critics maintain, we tend to move our head, albeit conconsciously, to provide another set of data for the brain to process.

To the degree that this is true, it undermines the more simplistic claims that are sometimes made for the binaural approach. In a binaural listening situation, there are no automatic visual clues; and the listener cannot move his/her head relative to the sound source, because he/she is wearing it! How then can they resolve any back/front or up/down ambiguity?

These problems are acknowledged in an article in the German magazine "Funkschau" by Drs Griese and Wichmann. They report convincing results with the total triaxial system when recordings, made in concert halls or jazz cellars, were heard in the same environment. Even away from the environment, the recollection of the original situation was sufficient to dispel directional ambiguity.

However, for those unfamiliar with the recording situations, the writers suggested they be supplied with a sketch, or else simply be seated facing the now-silent loudspeakers as a hint that most of the sound should be coming from there!

Significantly, Sennheiser's own records carry clues,

Latest addition to Sennheiser's range of "Open-Aire" headphones is this model HD 44. Light in weight and fitted with a long lead, the headphones are highly practical. Quality of reproduction is good and adequate for normal hifi/stereo listening as well as for possible experiments with binaural techniques. Available through R. H. Cunningham Pty Ltd, they are expected to retail at about $27.00.

presumably for the same purpose. A sure-fire ground for argument is whether the clues are necessary.

And, of course, it leads to the contention that, if the binaural or "triaxial" system suffers a basic sonic ambiguity, there is little point in getting too excited about it. The method is just as open to criticism as any other.

One other point is fairly obvious: Anyone wearing the microphone for the purpose of recording would need to keep their head very still during the procedure. Failure to do so would produce a quite unexpected effect during playback: without apparent explanation, the performers would suddenly circle around to the left or right, and then back again!

But, despite these reservations and criticisms, R.H. Cunningham report a consistent interest in Sennheiser's "Triaxial" system and they can supply, ex-stock, dummmy heads, wear-it-yourself microphones and, of course, "Open-Aire" headphones—the latter equally suitable for binaural or ordinary stereo listening.

Who buys them? Predominantly, we understand, audio enthusiasts who have the urge and the money to climb out of the hifi mainstream for a while and do their own thing!

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Yamaha CR-200 FM-AM stereo receiver

While Yamaha have in the past concentrated on producing relatively expensive equipment, they have now introduced a stereo FM/AM receiver at under $300 which has a power output of 15 watts RMS per channel.

Simple styling characterises the Yamaha CR-200 but it still manages to look different from most other high-fidelity equipment. Dimensions are 400 x 133 x 293 mm (W x H x D) and weight is 7.2kg.

Front panel design is very clean with little in the way of gimmickry. A single tuning meter indicates signal strength in both FM and AM modes. There are two LED indicators, one a mains pilot and the other for the FM stereo beacon. The tuning pointer is in the form of a slide-rule cursor which is slightly curved to provide some magnification of the dial calibrations.

A rotary switch is provided for selection of either or both of two loudspeaker systems or to turn them off completely. At the far right of the panel, a similar switch acts as source selector. Toggle switches are provided for Power, Tape Monitor and Loudness.

If we have any hassle at all with the front panel layout it concerns the volume control. Since it is the most oft-used control we believe it needs to be differentiated from the other three in the group, Bass, Treble and Balance. Otherwise, one tends to grab for the largest knob on the panel and this happens to be the tuning knob.

Rear panel layout is much like any other receiver in this price range. One feature we would prefer not to see is the rotary mains voltage selector (you need a large coin to turn it). It is all too easy for some meddlesome child to rotate this to 110VAC, which means damage on the next occasion of use. If I purchased this receiver I would glue the voltage selector or take a similar measure to prevent it ever being incorrectly set.

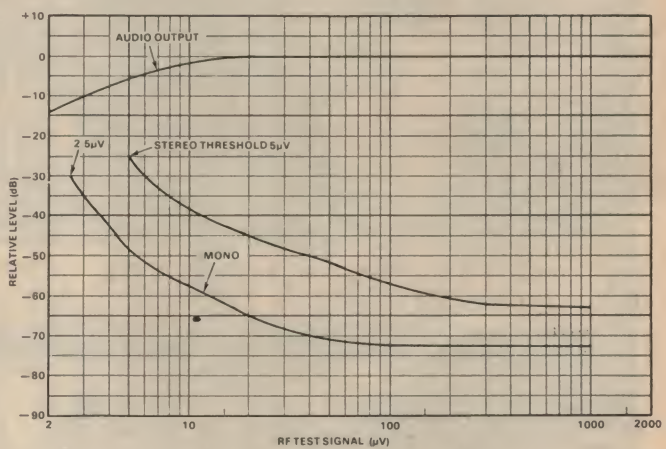
Our sample receiver was fitted with a two-core power flex but the distributors assured us that units supplied to the public would be fitted with three-core flex and a three-pin power plug.

A plastic-sleeved rotatable bar antenna is provided for AM reception. For FM reception terminals are provided for termination of either 300 ohm ribbon or 75 ohm coaxial cable. A light ribbon made up into a simple dipole antenna is supplied with the receiver but for weak signal areas or areas where multipath reception may be a problem, a better antenna would be required.

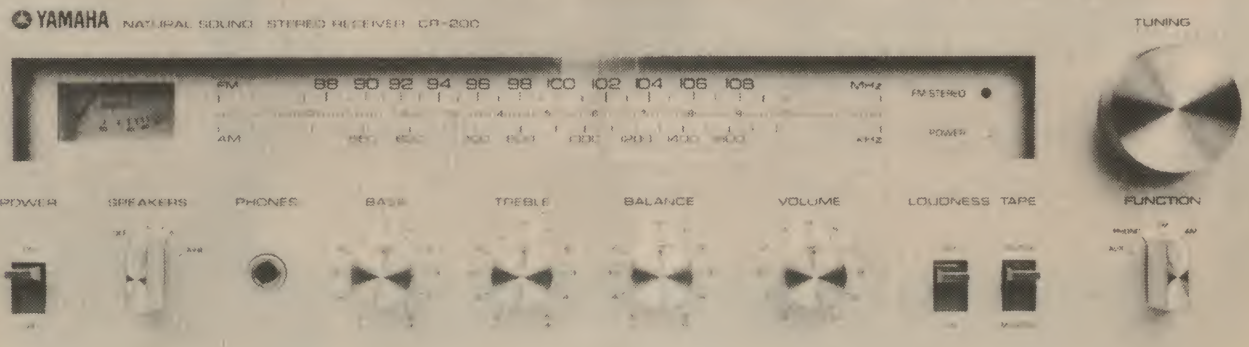
An interesting note of the underside panel is that it is made from vinyl-coated steel (similar to Marviplate) and the vinyl faces up to the PC copper pattern, so that if the board does happen to buckle and touch the panel, no shorts will result. The same material is used for the pseudo-woodgrain top cover of the receiver.

Removal of the receiver's underside panel allows access to the whole of the copper pattern, to allow easy service. The copper pattern shows evidence of careful design to avoid common impedance paths, which can be a real bugbear in amplifier design.

All the switches on the front panel,



Graph showing FM sensitivity for various levels of quieting in both mono and stereo modes.



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except for the power switch, are mounted on the PC board as are the various potentiometers. The switches are interesting in that they are actually multi-position slide switches which are gear driven (rack and pinion, actually) to provide either rotary or toggle action on the front panel.

All circuitry, except for the FM tuner front end, is mounted on a large PC board measuring approximately 350 x 150mm. Because it is so large, the PC board has lateral mild steel strengthening ribs to prevent warping.

Fairly conventional circuitry is used throughout the receiver. Both the FM IF stages and the multiplex decoder use integrated circuits while the simple AM tuner uses discrete components. Phono equalisation and preamplification is provided by two seven-pin in-line integrated circuits while the feedback tone control stages uses discrete transistors.

The power amplifiers use plastic-encapsulated power transistors in quasi-complementary mode and the output signal is coupled to the loudspeakers via 2200uF capacitors. The power transistors plus the thermal compensation transistors in each channel all attach to the one compact aluminium heat-sink which is attached to the PC board.

The five-gang tuning capacitor plus integral FM front-end PC board mounts by itself at the rear of the chassis and is connected to the dial via a rather long dial cord. Tuning is very smooth, mainly as a result of the large flywheel.

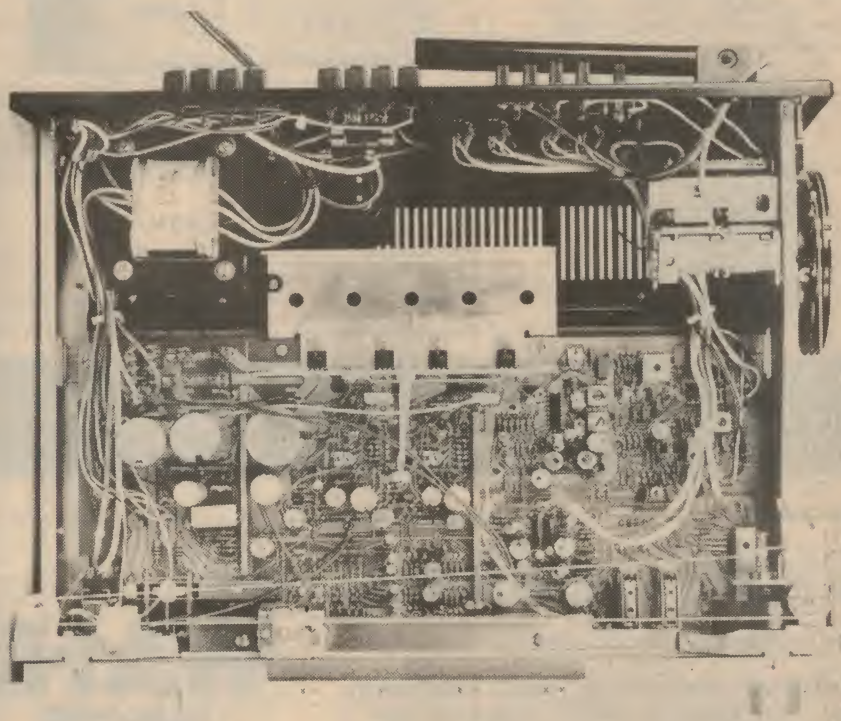
A well-writen instruction manual is supplied with the receiver. Besides having an unambiguous text, it has easy-to-understand diagrams which make it a cinch to connect the other items in a complete system. A brief trouble-shooting chart allows the user to diagnose most of the typical faults which occur during an initial installation.

Rated power of the Yamaha CR-200 is 15 watts RMS per channel, with both channels driven into 8 ohm loads at any frequency between 20 and 20kHz and with harmonic distortion less than 0.5%. At 1kHz (ie, midband) it is rated at 18 watts into an 8-ohm load with one channel driven.

We measured power into 8-ohm loads at 14 watts RMS per channel with both channels driven at any frequency over the bandwidth stated above. With one channel driven, power was 18 watts RMS into an 8-ohm load.

No mention of loudspeaker loads other than 8-ohms was mentioned in the instruction manual although use of 4-ohm loudspeakers was condoned by implication, since it states that two sets of 8-ohm loudspeakers may be connected and used simultaneously. What the manual should state is that two sets of 16-ohm or 8-ohm loudspeakers can be used simultaneously, but only one set of 4-ohm loudspeakers.

This matter of loudspeaker loads is confusing to many high fidelity enthusiasts and could be better explained in most instruction manuals including that for the receiver under discussion. Of course for most users this problem will not arise since they will use 8-ohm loudspeakers.



Most of the circuitry in the CR-200 is contained on one large PC board.

We measured power into 16 ohm loads at 10.5 watts with one channel driven and 9 watts per chanel with both driven. With 4-ohm loads, power was 25 watts from a single channel and 16 watts per channel with both driven.

Our two diagrams show the harmonic distortion versus power and versus frequency. As can be seen from these, the distortion is, for the most part, below 0.1% except below 100 milliwatts where noise predominates and masks the actual reading. The distortion versus frequency diagram is taken at a power level of 10 watts RMS into an 8-ohm load. Here again, the distortion is below 0.1% except for the rise below 50Hz.

Damping factor is quoted at 40 for an 8-ohm load at 1kHz. We measured it at 50 but this is a relatively irrelevant measurement at 1kHz since it is only in the "piston range" of loudspeaker operation that damping factor is of any use. Accordingly, we measured damping factor at low frequencies where it was likely to be degraded by the output coupling capacitor. At 50Hz it was 33; at 30Hz it was 25 and at 10Hz it was 8, which is still quite a reasonable value.

Frequency response was not quoted but we measured it at 30Hz to 60kHz between −1dB points at a level of 1 watt. RIAA equalisation was within less than 1dB from 30Hz to 15kHz. Phono sensitivity was 3mV at 1kHz and overload occurred at 135mV, exactly as claimed.

Separation between channels ranged from 70dB at 100Hz to 36dB at 10kHz. Square wave response was very good and stability testing with capacitances shunting the load uncovered no problems.

Signal to noise ratio measurements produced some of the quietest figures we have seen. For example, with the auxiliary input open-circuit, the unweighted signal-to-noise ratio was minus 83dB with respect to 18 watts into 8 ohms. And with the phono input short circuit, the S/N ratio was 80dB with respect to 18 watts and referred to an input signal of 10mV at 1kHz. With a typical cartridge and turntable connected, the figure was about 70dB.

A fairly modest FM tuner is incorporated into the CR-200. It does not have AFC or muting which are refinements found on more expensive receivers. However, many users would argue that refinements such as muting are not required in Australia anyhow. It may be many years before we have a whole range of stations to tune across.

(Continued on page 22)

Sound Technology 1000A/1100A FM stereo multiplex test set has less than 0.1% THD

Now that FM stereo receivers are such a big-selling item on the Australian high-fidelity market, there is a considerable need for high performance FM test equipment such as Sound Technology's 1000A/1100A precision FM multiplex generator test set.

While the primary purpose of the 1000A FM alignment generator and its companion 1100A signal conditioner is fairly obviously for use in laboratories and service workshops for design and repair of high quality FM receivers we understand that it is sold in large numbers to high fidelity retailers in the USA.

The high fidelity retailer uses the 1100A/1000A combination as a miniature high quality FM transmitter. The system accepts programs from disc or tape and converts it to a high quality FM stereo multiplex signal anywhere in the range from 88 to 108MHz.

The test set has an optional matching transformer to enable the RF signal to be coupled directly to a receiver's 300 ohm antenna terminals.

The 1100A/1000/A can thus provide an FM signal of known quality at any time, regardless of actual FM reception conditions. Thus it can be used to demonstrate FM receiver performance such as sensitivity, separation between channels, signal-to-noise ratio and many other parameters.

Prospective buyers of FM stereo receivers would be able to judge for themselves the worth of competitive models rather than being "sold up" to a few gimmicky features.

As well as being a very worthwhile sales aid, the 1100A/1000A permits fast and accurate adjustment of stereo FM receivers. The 1000A has a Dual Sweep mode which is a refinement of conventional sweep alignment technique, to provide a unique visual display of the demodulator performance. More about this later.

Both the 1100A and 1000A have the same finish with the front panels in "Model T" black while the cases are off-white crackle enamel. Labelling on the front panels is screen-printed in white which makes a good contrast for easy legibility.

Dimensions of the 1000A are 283 x 213 x 298mm and weight is 26.4kg while dimensions of the 1100A are 283 x 140 x 298mm and weight is 13.2kg.

The 1100A signal conditioner is a relatively simple unit by comparison with the 1000A alignment generator. It can accept high level inputs from a tape deck or audio oscillator and low level signals from a magnetic cartridge. These are equalised and amplified, and pre-emphasis is applied with time constant of 25, 50 or 75 microseconds.

Sound Technology 1100A and 1000A constitute a complete FM multiplex stereo test set.

All the circuitry inside the 1100A is accommodated on a double-sided PC board and uses 709 operational amplifiers. All time constant components are one percent tolerance.

Left and Right outputs from the 1100A are coupled via BNC connectors and shielded cable. Similarly, all outputs and inputs on the 1000A are via BNC connectors. Both units are supplied with removable three-core mains cord and the standard Australian three pin mains plug.

RF output level from the 1000A generator is controlled by a piston attenuator which works in the following way: the RF oscillator is contained in a metal can mounted at the top of the piston attenuator tube. The oscillator circuit is a single transistor with capacitive feedback to the base. Radiation from oscillator tank coil is propagated down the attenuator tube which is a waveguide operating below cut-off. Attenuation down the tube follows a precise logarithmic law. The RF attenuator control actually moves a pickup loop up and down the attenuator tube with the position of the loop in the tube accurately determining the RF output level.

In fact, the pickup loop is a 51 ohm resistor coupled via a .001uF capacitor and a short length of coax cable to the output socket. Thus the whole attenuator system is a remarkably simple and precise way of varying the output level from less tham 0.5uV up to more than 30mV at an impedance level of 50 ohms.

The 38kHz subcarrier and 19kHz stereo pilot signal are derived from a 152kHz crystal oscillator. Both the crystal oscillator and divider circuitry utilise TTL integrated circuits. The 19kHz square wave from the TTL circuitry is converted to a sine wave by a 709 op amp wired as an integrator. The small phase error of the 19kHz pilot tone with respect to the 38kHz subcarrier is corrected by feeding the 19kHz through a passive RC network.

A Wein bridge wired around another 709 op amp provides the internal oscillator is obtained by means of a FET in the feedback loop. *(Continued on page 22)*

YAMAHA CR-200

The AM section is more limited in performance, that is to say it is on a par with those found in most FM/AM receivers. Sad.

FM sensitivity for various levels of quieting in mono and stereo mode is shown on the first page of this review. Ultimate signal-to-noise ratio in the mono mode was better than 70dB while in the stereo mode it was better than 60dB. The measurements are taken with respect to 100% modulation (ie, 75kHz deviation). The stereo S/N ratio was taken using a sharp cut-off low-pass filter to remove residual 19kHz and 38kHz components which otherwise degrade the performance to yield a S/N ratio of about 53dB.

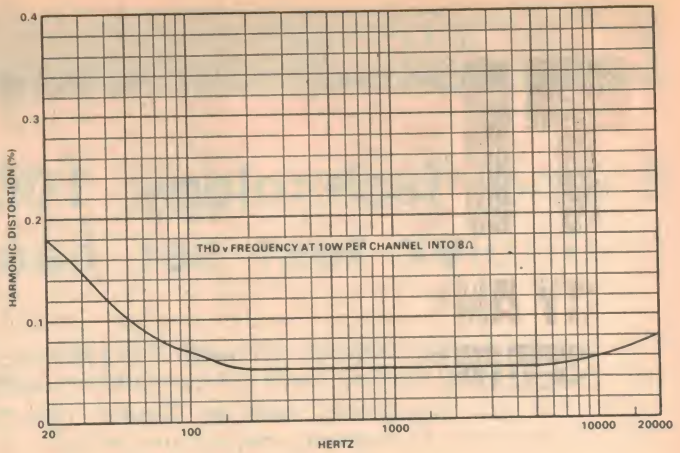
In this latter respect, the low-pass filters at the output of the CR-200 multiplex decoder could be improved, especially where tape recording of broadcasts is contemplated.

Harmonic distortion is quoted at 0.3% in mono mode and 0.8% in the stereo mode, although the method of test is not stipulated. Our method is to use a signal of 1mV at the antenna, 100% modulated. This yielded figures of 0.85% in mono and 0.9% in stereo. Stereo separation is quoted at 40dB at 400Hz. We measured it at 33dB at 100Hz, 35dB at 1kHz and 32dB at 10kHz.

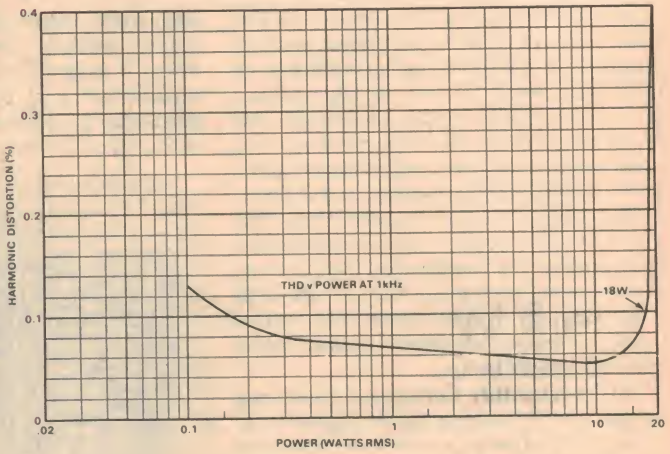
Frequency response was quoted at 50 to 10kHz within □1dB and this we were able to confirm. At 15kHz, the response was 10dB down.

Pre-emphasis specified for Australian FM stations is 50 microseconds and the de-emphasis for tuners should be same figure. On the sample receiver it was 75 microseconds but we assume this will be changed to the correct figure on those sold to the public.

Total harmonic distortion versus frequency gave a maximum reading of less than 0.2%.



Distortion measurements at powers below 100 milliwatts are masked by noise.



During listening tests the Yamaha CR-200 performed very well and revealed no problems in this operation. RF and radar breakthrough into the audio small-signal stages was not apparent.

At the recommended price of $279 including sales tax, the Yamaha CR-200 can be considered a good buy. It has all the facilities that the average user requires and has a well balanced performance.

Further information on the Yamaha range of equipment can be obtained from high fidelity retailers or from the Australian distributors, Rose Music Pty Ltd, 17-23 Market Street, South Melbourne, Victoria or interstate offices. (L.D.S.)

SOUND TECHNOLOGY 1000A/1100A

One feature of the 1000A which could be confusing, especially to an imexperienced user, concerns the modulation meter. This reads FM deviation up to 150 per cent and Sweep Width up to 600kHz. FM deviation at 100 percent just happens to result in a modulation bandwidth of 150kHz (±75kHz) so it can be quite easy to misread the meter scales and consequently foul up the test results.

FM deviation of up to 150% is provided to test the overload characteristics of FM receivers. Some receivers distort quite badly once deviation exceeds 100% (a not uncommon situation in the USA apparently).

The Dual Sweep is adjustable up to 600kHz as mentioned above. The dual sweep modulation consists of a 50Hz sinewave (derived from the mains) with a 10kHz sinewave superimposed on it. The 50Hz amplitude is very much larger than the 10kHz so it can be used for conventional sweep alignment.

To use the Dual Sweep the output from the receiver under test is coupled into the RCVR terminal on the 1000A. This passes the signal through an active filter to remove the large 50Hz component to leave just the 10kHz modulation. The detector characteristic can then be displayed on an oscilloscope using the VERT and HORIZ ouputs from the 1000A. Waveforms are shown in the manual illustrating typical non-linearity conditions. As an interesting sidelight, the dual sweep facility can also be used to measure intermodulation.

Another feature of the 1000A is that it has adjustable stereo pilot amplitude, up to 20%. Some receivers are quite critical as far as pilot amplitude is concerned, so this is another important facility.

Stereo separation is quoted at more than 50dB at 1kHz. Harmonic distortion for mono signals is less than 0.1% at 1kHz for mono and less than 0.2% for stereo at 100% modulation. In the CW mode, receiver quieting can be measured to minus 70dB.

We have used the 1100A/1000A combination on several receivers in our laboratory and can testify that it is a precision instrument, well designed and well constructed. Any organisation considering the purchase of FM stereo test facilities should certainly look at what the Sound Technology combination has to offer.

Further information on Sound Technology equipment can be obtained from the Australian distributors, Arlunya Pty Ltd, PO Box 113, Balwyn, Victoria 3103. (L.D.S.).

THE NEW '#TWO'

BY ANY MEASURE OF PERFORMANCE... THE CARTRIDGE SECOND ONLY TO THE SHURE® V-15 TYPE III

NEW!

M95ED Deluxe High Trackability Cartridge

Second only to one! The Shure M95ED combines several of the high-performance design features of the Shure V-15 Type III to deliver exceptional trackability (at ¾ to 1½ gram forces). A radically new internal electromagnetic structure insures a level of total performance surpassed only by the Type III. The M95ED incorporates a new, thinner, uninterrupted pole piece developed by Shure design engineers to optimize electromagnetic characteristics—especially at higher frequencies. As a result, magnetic losses have been minimized, and frequency response remains essentially flat across the entire frequency range.

With its nude-mounted, biradial elliptical stylus tip, the M95ED has a very low effective stylus tip mass. This results in higher trackability to maintain perfect groove contact through the "hottest," most heavily modulated passages encountered on modern recordings—all at extremely light tracking forces that reduce record wear and increase stylus tip life. And, as a "plus," its exceptional trackability makes the M95ED an outstanding choice for use in four-channel encoded (matrix) systems.

AE095/FP

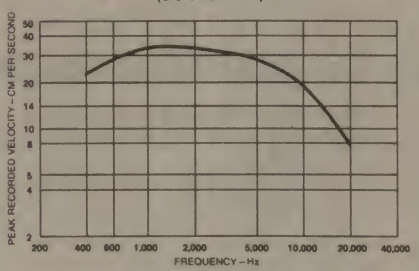
M95ED SPECIFICATIONS

Trackability at 1 gram tracking force using a Shure/SME Arm:

24 CM/SEC at 400 Hz
33 CM/SEC at 1,000 Hz
28 CM/SEC at 5,000 Hz
19 CM/SEC at 10,000 Hz

Tracking Force: ¾ to 1½ grams
Frequency Response: 20 to 20,000 Hz

TRACKABILITY CHART
(at 1 Gram)



Optimum Load

47,000 ohms resistance in parallel with 400 to 500 picofarads total capacitance per channel. (Load resistance can be as high as 100,000 ohms and total capacitance can be as low as 100 Picofarads with only minor audible change.) Total capacitance includes the capacitances of the tone arm wiring, phono cables, and the amplifier input circuit.

Output Voltage: 4.7 mV per channel at 1,000 Hz at 5 CM/SEC peak velocity

Channel Separation: Minimum 25 dB at 1,000 Hz

Channel Balance: Output from each channel within 2 dB

Stylus: N95ED Biradial elliptical with nude diamond tip

17.8 microns (.0007 inch) frontal radius

5 microns (.0002 inch) side contact radii

25 microns (.001 inch) wide between record contact points

78 rpm Stylus: N95-3 Spherical—63 microns (.0025 inch)

Inductance: 650 millihenries

D.C. Resistance: 1550 ohms

Weight: 6 grams

Mounting: Standard 12.7 mm (½ inch) mounting centers

FOR HEAVIER TRACKING TURNTABLES AND TONE ARMS

. . . Shure designed the M95EJ Custom high trackability cartridge. It uses the same newly developed pole piece as the M95ED and delivers a frequency response virtually identical in its flatness—but at slightly greater tracking forces. The M95EJ features a biradial elliptical stylus tip, and tracks at 1½ to 3 grams. An ideal cartridge choice for audiophiles who want to upgrade their record playback systems at moderate cost!

Recommended Retail Prices: **M95ED $47 — M95EJ $30**

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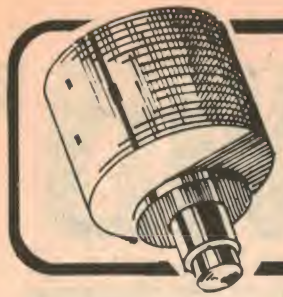

News Highlights

GE develops fast access computer memory

A new all-electronic bulk memory that permits computers to access stored information up to 1,000 times faster than is possible with today's rotating magnetic memories has been developed at the General Electric Research and Development Center, Schnectady, New York.

Combining an electron beam for fast access and a special semiconductor target for very-high-density storage, GE's new BEAMOS (Beam Addressed Metal Oxide Semiconductor) memory is designed primarily for military applications. Eventually, it may also be marketed for commercial computer systems.

The first 32-million-bit BEAMOS module has an access time of 30 millionths of a second and a transfer rate of ten million bits per second. By contrast, mechanical disc memories now widely used in computer systems have an access time of 30 thousandths of a second.

The dramatic decrease in access time attained by the BEAMOS memory could eliminate inefficient use of computer time that now occurs when the central processor has to await data coming from its slower auxiliary memory. This "access time gap" between rapid main memories and slower mechanical auxiliary memories has been a major bottleneck to speedier processing and increased productivity from computer systems.

The electron beam and the semiconductor target in the new GE memory are housed in a vacuum module, with no moving parts. BEAMOS is thus particularly suited for computers aboard military vehicles, airplanes, and spacecraft where shock, vibration, and rough handling—combined with dust and dirt—usually rule out conventional mechanical memories. Moreover, data will remain intact in the BEAMOS memory even if power is interrupted.

Key elements of GE's new electronic memory are the storage plan of four small unstructured (15-millimetre-square) silicon storage chips, each with a capacity of eight million bits, plus a unique "matrix electron lens" with 289 separate lenslets that direct a cathode ray beam to read, write, or erase at the precise memory site on the chips.

In a computer memory system, 16 or more BEAMOS modules could be linked in a computer rack to provide 500 million bits of memory. Such a system could be accessed in parallel to provide data transfer rates of 160 million bits per second. Laboratory tests indicate that capacity of a single module could be expanded to a billion bits

Microprocessors ready for market impact

The US electronics industry has made such significant advances in the miniaturisation of computer circuitry in recent years that it is now pushing for the introduction of computer controlled functions in such things as automobiles, gasoline pumps, traffic control signals and supermarket cash registers. In addition, the latest miniaturisation phase is expected to increase the power and lower the cost of desk top minicomputers, and to give increased independence to computer terminals now used only to gain access to large central installations.

The technology involved is the so-called semiconductor memory, a device designed to be much cheaper, faster and more compact than the ferrite core memories that have dominated the field. Semiconductor memory technology in turn led to so-called microprocessors, tiny devices that could be hooked up with memories to make microcomputers on a single chip of silicon a few millimetres square.

Although it is just five years since semiconductor memories became a commercial reality, they are already generating large sales for electronics companies. One example is Intel Corporation of Santa Clara, California, which chalked up sales of $134,500,000 in 1974. Other companies active in this field include IBM, Texas Instruments, National Semiconductor, and Motorola.

Microprocessors will eventually change the format of computer operations from centralised processing to local processing. Industry leaders foresee the time when entire batteries of microprocessors work like clerks in an office, with one or more of them exercising executive control. In the meantime, microprocessors are being installed in what the industry calls "smart" instruments.

Reflecting keen interest in new developments, the automobile industry is sponsoring seminars and extensive research programs aimed at demonstrating the practicality of microcomputers in cars. In the opinion of many observers in the industry, microcomputers, both for precisely controlling the burning of fuel in car engines and for antipollution devices, will be indispensable in reducing pollution and achieving fuel economy. However, major problems of cost and reliability will have to be solved.

Engineers at Intel and elsewhere say that even if microprocessors do not find a place in hot, corrosive automobile engines and exhaust pipes, they might achieve significant fuel savings another way.

As an example, Harold V. Feeney Jr., marketing manager for Intel's Micro Computer Systems Division, cited left turn traffic signals that do not let all cars in a left turn line go through on one light. "It might now be possible to take a dumb signal and with a few hundred dollars of microprocessors, add some intelligence to it," Mr Feeney said.

Dr John R. Pierce of the California Institute of Technology, writing in Scientific American magazine, mentioned one estimate that fuel consumption might be reduced 10 percent in areas controlled by sophisticated systems.

— George E. Toles

Interference problem at Goonhilly eliminated

The problem of suppressing unwanted signals which interfere with transmissions from communications satellites has been successfully solved at the Satellite Earth Station, Goonhilly Downs, Cornwall.

Goonhilly Downs forms part of the Intelsat satellite communications network which links virtually every major country in the world via satellites maintained in fixed positions over the Atlantic, Indian and Pacific Oceans.

Unfortunately, the Indian Ocean satellite appears at a low angle from Goonhilly, and the aerial working to it has to be aimed across France—almost in direct line with a French radio-relay station. This station transmits on frequencies in the 4GHz band, and is capable of causing interference to signals received from the satellite. In some instances, the power of the interfering signal has exceeded the power of the wanted signal by as much as 30dB.

The interference problem was overcome by noise cancellation equipment developed and installed by Plessey Avionics and Communications under contract to the British Post Office. The technique employed is quite simple, and involved the installation of a small auxiliary aerial tuned to receive a significant level of the interfering signal only. By feeding a controlled amount of the output from the auxiliary aerial into the main aerial receiver, any interference can be effectively cancelled.

Advanced navigation system for US tuna boats

Advanced navigation systems that convert electronic bleeps from satellites into highly accurate position pinpointing are being introduced into the US tuna fleet this year aboard two San Diego-based seiners, the Capt. Joe Medina and the Kerri M.

The computer-operated Magnavox satellite navigation systems will save time and fuel and will provide an extra measure of safety, according to Joe Medina Jr, captain of the vessel named after his father.

The electronic navigation system, first developed for the US Navy, will provide Medina with his exact location at any given moment. In addition, the system will compute the exact course to be followed to any destination in the world, together with other needed data.

The systems will be particularly useful for reaching the exact sites where fishing has been good in the past, according to Medina. They are also expected to be effective in bad weather and in areas where currents may cause a boat to drift 50 to 60 kilometres in a night.

The $30,000 systems operate off signals emitted from eight satellites in polar orbits, and are accurate to within a few hundred metres. —George E. Toles.

Hitachi develops large area LCD display

Hitachi Ltd, Dai Nippon Toryo Company Ltd, and Ashai Glass Company Ltd have pooled resources to produce a large-area liquid crystal display system. Measuring 0.4 x 0.5 metres, the new LCD display is the largest in the world, and is capable of displaying some 600 alphanumeric characters.

The development of large-area liquid crystal displays has been held up in the past by the long time lag between the application of a voltage signal and the corresponding change in display transparency. In this case, the problem was overcome by employing a "dynamic scattering mode", and by improvements to the liquid crystal material, method of panel fabrication, and driving techniques. Under the dynamic scattering mode of operation, the display indicates characters by whitening the liquid crystal material when a voltage is applied.

Hitachi lists several possible application areas for the new large-area LCD. These include computer terminals, sign-boards at airports and railway stations, and electronic black-boards.

Airborne infrared survey shows US fuel waste

A US midwestern utility company is using an aerial survey technique to measure rooftop heat losses from homes and commercial buildings, thus enabling owners to determine whether or not they are wasting fuel because of inadequate insulation.

Cengas, the natural-gas distributing division of Central Telephone and Utilities Corporation, surveyed five communities in Nebraska and South Dakota on cold, clear nights last winter. Now the company is providing the results to individual property owners in time for them to add insulation or make roof repairs before next winter.

After a feasibility test flight over Brookings, the entire communities of Lincoln, Beatrice, Columbus and Norfolk, in Nebraska, and Sioux Falls, in South Dakota, were surveyed with a thermal-infrared scanner flown at an altitude of 488 metres in a twin-engine plane. The surveys took two nights for Lincoln, which has a population of about 150,000, and one night each for the other four communities.

As the plane made successive runs over strips about three city blocks wide, roof surface temperatures were recorded on magnetic tape. Electronic equipment at the Remote Sensing Institute, South Dakota State University, converted the data to strips of film, which were then printed on photographic paper.

In the resulting imagery, called thermograms, silhouettes of individual buildings are easily seen. Warm roofs appear in light tones and cool roofs darker. Cengas officials estimate that at least 60,000 buildings in the five communities are losing excessive amounts of heat.

Important breakthrough in sea power research

Mr Stephen Salter, of Edinburgh University's department of mechanical engineering, has received a £110,000 grant from the British Government to enable investigations to continue into a system he has devised for converting the motion of sea waves into electricity or some other form of energy.

Basically simple in concept, Mr Salter's method involves the stationing at suitable offshore locations of large concrete breakwaters fitted with movable vanes which would convert wave motion into electricity. Calculations have shown that a structure the size of a supertanker, submerged to a depth of 10 to 20 metres and with the vanes protruding a metre above the surface, could generate 5 megawatts of electricity throughout the year—about a tenth of the needs of a large town.

There is no theoretical reason, Mr Salter says, why a large part of Britain's electricity demands could not be met by a batch of these offshore generators stretched out across the Atlantic at suitable intervals. The breakwater effect of the structures, he claims, would create a sheltered area of calm water behind them which would be attractive to fishing and sailing craft. In addition, energy from the waves would have the advantage of producing a peak output during the winter storms when demand for power would also be greatest. This is the reverse of the often-mooted solar power schemes which are not considered feasible in northern latitudes.

LOGIC DESIGNERS

For less money, you can now design 2mW per gate digital systems that operate at twice the speed possible using standard TTL.

With Fairchild 9LS low power Schottky TTL circuits, logic designers can now create 2mW-per-gate digital systems that operate at twice the speed possible using standard speed TTL devices. System design is simplified because of low power requirements, reduced heating and low noise operation. This new TTL family operates at gate delays of only 5 ns typical, 10 ns worst case, which is twice the speed of standard 54/74 or 54LS/74LS low power Schottky TTL devices.

The speed/power performance allows the 9LS circuits to replace standard TTL, high speed TTL, low power Schottky (including 54LS/74LS) and some standard Schottky TTL parts with a power savings of 500 to 1000%.

The economies of 9LS do not end with component cost. Figures 1 & 2 illustrate the greater ac stability of 9LS with temperature and loading.

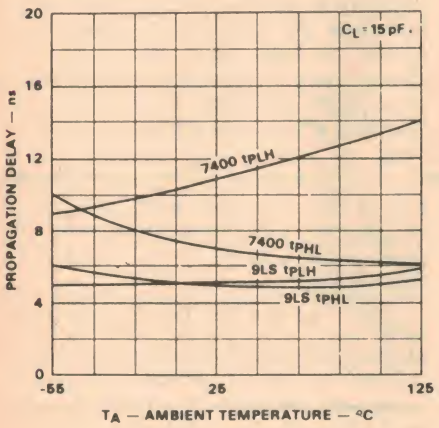

Figure 1

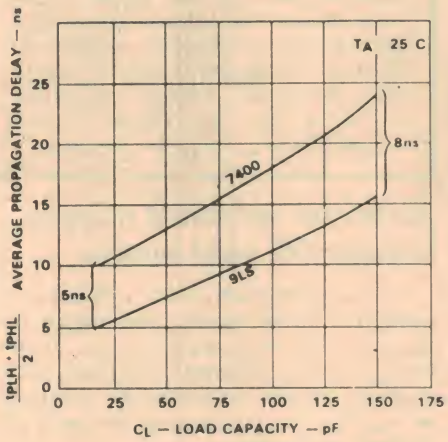

Figure 2

This translates into easier design and fewer problems in the field. The fan-out of LS is 20 into other LS circuits, which means fewer added components for buffers. Schottky gates, used as clock or bus drivers have fanouts of 50 into LS resulting in component savings as well as fewer clock skew problems. LS is fully compatible with Fairchild 34000, RCA 4000B or National 74C CMOS. It can go to and from CMOS without external components. Interface with other MOS devices are also simplified; MOS typically exhibits a fanout of four LS loads.

- **Low Power** — Next to CMOS the lowest of any modern logic family. In fact, it's lower than CMOS at frequencies of 2 MHz and above.
- **Low cost** — Apart from saving on components, Fairchild 9LS in most instances costs less than standard TTL.
- **High Performance** — the best speed this side of standard Schottky. It's faster than H series at 1/10 the power.
- **Good Temperature performance** — The ac characteristics of our 9LS/54LS are extremely stable with temperature.
- **High Capacitance Drive Capability** — Actually superior to standard power TTL.
- **Compatibility** — 9LS/54LS is directly compatible with all TTL families and modern CMOS families such as 34000, CD4000B and 74C. Fairchild 9LS meets all 54LS/74LS for second sourcing.

Fairchild 9LS

9LS00	Quad 2-Input NAND Gate
9LS02	Quad 2-NOR Gate
9LS03	Quad 2-NAND Gate (O/C)
9LS04	Hex Inverter
9LS05	Hex Inverter (O/C)
9LS10	Triple 3-NAND Gate
9LS11	Triple 3-NAND Gate (O/C)
9LS15	Triple 3—AND Gate (O/C)
9LS20	Dual 4-NAND Gate
9LS22	Dual 4-NAND Gate (O/C)
9LS32	Quad 2-OR Gate
9LS51	Dual AND-OR Invert Gate
9LS74	Dual D Flip-Flop
9LS86	Quad Exclusive OR Gate
9LS109	Dual JK Edge Trigg. Flip-Flop
9LS112	Dual JK Edge Trigg. Flip-Flop
9LS113	Dual Edge Trigg. Flip-Flop
9LS114	Dual JK Edge Trigg. Flip-Flop
9LS136	Quad Exclusive OR (O/C)

And 9LS/MSI

9LS138	1-of-8 Dec/Demultiplexer
9LS153	Dual 4-Input Multiplexer
9LS174	Hex D Flip-Flop W/Clear
9LS175	Quad D Flip-Flop W/Clear
9LS196	Decade Counter
9LS197	4-Bit Binary Counter
9LS253	Dual 4-Input Multiplexer 3-S

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NEWS HIGHLIGHTS

Distinguished guests at IREE Convention

The International Electronics Convention '75 was held at the University of NSW from 25 to 29 August, 1975. Mr F. R. Lackey (standing), president of the Institute of Radio and Electronics Engineers, introduced two prominent overseas guests at a press conference on the opening day. Keynote speaker for the Convention was Mr David R. Israel (far left), Deputy Associate Administrator for Engineering and Development, Federal Aviation Administration, USA. Mr Israel spoke on "Electronics in the Future of Air Traffic Control." Seated next to Mr Israel is Dr Walter Bruch, professor at Hanover Technical University, who developed the PAL system of colour TV. Dr Bruch's address was on "AM and FM Broadcasting." Seated next to Dr Bruch is Mr K. L. Finney, general secretary of the IREE.

New solid state microwave power device

A new solid state microwave device, similar in principle to a transistor but designed for operation at much higher frequencies, has been developed by scientists at the General Electric Research and Development Center, Schenectady, New York.

Microwave power transistors are now commercially available only at frequencies up to about 3GHz. GE's new "Controlled Avalanche Transit Time" (CATT) triode, by contrast, will make possible simplified microwave power amplifiers that operate at frequencies as much as seven times higher.

In addition, at lower frequencies the CATT triode should be capable of higher pulsed (intermittent) power than available transistors, according to its developers, Dr Se Puan Yu and Dr Wirojana Tantraporn.

The CATT triode can be used in simple circuits without the need for the frequency multiplication required by conventional microwave transistors, or other circuit complications, such as those needed by IMPATT diodes. The lower-frequency, high-pulsed-power capability is made possible by a reduction of the base widening or Kirk effect, which limits conventional transistor peak powers.

The CATT triode is a marriage of transistor and IMPATT design. As in a transistor, a low-power input signal is fed to the emitter-base junction, providing a signal controlled injection of electrons into the base region, and the base-collector junction is operated with reverse bias. The base-collector depletion region has an IMPATT diode configuration with the avalanche zone close to the base.

Initial steps toward the development of the CATT triode were carried out making extensive use of computer simulation. The developers predict that it will find numerous applications, since there is a continual move toward higher-frequency operation as the radio spectrum becomes more and more crowded.

NASA satellite pinpoints cosmic ray sources

A NASA scientist believes he is close to solving a 75-year-old astrophysical mystery—the origin of cosmic rays.

Dr Floyd W. Stecker of Goddard Space Flight Center, Greenbelt, Maryland, says cosmic rays—the most energetic particles in the universe—almost certainly come from supernovas (exploding stars) in our own galaxy. His conclusions are based on data obtained from NASA's Small Astronomy Satellite B or SAS-B (explorer 48), which has been scanning regions of the Milky Way since 1972, observing gamma rays.

Gamma rays result primarily from collisions of cosmic rays with interstellar gas. Knowing the directions from which most of the gamma rays came (as a result of SAS-B data), Stecker was able to pinpoint an area of intense activity located about midway between the galactic center and the Earth.

Most of this activity could be shown to be due to the large number of gas clouds in this region. However, there were not enough gas clouds to account for all the gamma-ray production. This, together with a large drop-off in gamma rays elsewhere in the galaxy, showed that cosmic rays are not uniformly distributed throughout the Milky Way.

The area of most intense gamma-ray activity is seen by radio telescopes on Earth to be a region containing both numerous interstellar gas clouds and a large number of supernova remnants. From this data, Stecker deduced that cosmic rays are found in the same regions as supernova remnants and in proportion to their number in those regions.

However, the exact mechanism by which a supernova produces cosmic rays has yet to be proven. Current source theories include the acceleration of particles by the shock waves of a supernova explosion, a dynamo mechanism from a remnant pulsar, or electromagnetic acceleration by a remnant neutron star.

"One thing is certain," says Stecker, "we now have very strong evidence that cosmic rays are produced in the same regions as supernovas. They are the only logical galactic events able to produce particles of such energies. The galactic cosmic ray distribution appears to be indentical to supernova remnant distribution."

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If you already have a knowledge of the principles and practice of TV, this course will prepare you for the introduction of colour TV. Subjects covered in detail include: Colour in TV, the Colour TV system, Picture Tubes and Receiver Circuits for Colour TV, Troubleshooting Colour TV, Alignment of Monochrome and Colour Receivers and the PAL System.

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NEWS HIGHLIGHTS

Advanced synchronous satellites monitor US weather patterns

Two advanced Synchronous Meteorological Satellites (SMS-1 and SMS-2) are now in operation monitoring US weather patterns. Details of these new "weather watchdog" spacecraft were released recently by a three-man government/industry panel.

Joining in a press briefing at Aeronutronic Ford Corporation's Western Development Laboratories (WDL) Division, Palo Alto, California, where the two Synchronous Meteorological Satellites were designed and built, were Don V. Fordyce, SMS project manager, NASA; W. John Hussey, chief Field Services Division, National Environmental Satellite Service (NESS), National Oceanic and Atmospheric Administration (NOAA); and John Savides, SMS program manager, Aeronutronic Ford.

SMS-1 was sent into orbit in May, 1974, and its sister SMS-2 was launched last February. A third, and similar WDL satellite, known as Geostationary Operational Environmental Satellite (GOES-A), is now being readied for launch from Kennedy Space Center later this year.

These satellites are the first to go operational as part of a total global system expected to be in use by the end of this decade. Beginning in 1977, they will be joined by similar spacecraft from Japan, Europe and Russia.

"Weather view" of the western hemisphere, transmitted from 22,300 miles above the equator by SMS-2.

Mr Fordyce of NASA said that "SMS-1 and 2 represent a major step forward in the use of space observation to advance the science of weather forecasting." "These spacecraft built by Aeronutronic Ford are delivering the best meteorological data ever obtained from synchronous orbit satellites," he added.

Mr Hussey, who is responsible for providing operational satellite data and interpretive services to NOAA units in the field, said that "The SMS/GOES geostationary spacecraft represent a significant milestone in the generation of environmental satellites."

In addition to transmitting cloud-cover photos, the twin SMS satellites have the capability to receive and transmit information to NOAA from thousands of manned and unmanned data collection platforms around the US. This program is now in the early stages of implementation.

Primary types of data to be obtained will consist of meteorological, hydrological, oceanographic, seismic and tsunami information. For example, fixed platforms in remote land areas will send information to the satellites on earthquakes, temperature, wind direction and velocity, rainfall, and humidity. River platforms will measure currents, water levels and temperatures, etc.

In discussing the design of the SMS /GOES satellites built by Aeronutronic Ford, program manager Mr Savides said that they are "the most complex and advanced meteorological satellites in existence today." He said the satellites are designed for a five year operating life, and that pre-launch laboratory tests on the satellites carried out at WDL Division are among the most stringent in industry today, to insure this long life.

—George E. Toles.

Satellite in search for space civilisations

. . . attempts made to detect laser signals

A NASA satellite is observing three nearby Sun-like stars for signs that other civilisations may be trying to contact us with ultraviolet laser beams.

The satellite is Goddard Space Flight Center's Orbiting Astronomical Observatory (Copernicus), whose Princeton University telescope is scanning the stars epsilon Eridani, tau Ceti, and epsilon Indiall about 11 light years from Earth. These laser observations can only be made from a space observatory since the Earth's atmosphere prevents ultraviolet radiation from reaching the surface.

Leading the world's first "intergalactic laser communication experiment" is Herbert F. Wischia, a consulting electro-optical engineer from Stamford, Connecticut. According to Wischia, "lasers in the vacuum ultraviolet part of the optical spectrum represent an efficient and logical electromagnetic radiation source which could be used by an extra-terrestial community to announce their presence to us. Ultraviolet laser beacons offer the potential of high power combined with high efficiency."

Bits and pieces of evidence from astronomy, physics and biology suggest that life is not a one-time accident in the universe, but that it can appear spontaneously in a favourable planetary environment and evolve into complex beings, provided vast amounts of time are available. Consequently, the possibility exists that Earth is being irradiated from space by signals from intelligent civilisations on Earthlike planets circlng other suns.

This possibility has encouraged several American and Russian radio astronomy teams to search candidate stars for radio signals in the recent past, but without success.

The technical difficulties in detecting radio signals are related to knowing where to look and at what frequency to listen. Ultraviolet laser search experiments avoid this problem, according to Wischia.

Big contract to Pye TVT for Indonesian network

Pye TVT Limited, the Cambridge (UK) based manufacturer of television broadcasting systems, has just won an £8 million contract from the Ministry of Information of the Republic of Indonesia.

The systems to be supplied by Pye will form part of a complex television and communications network currently being constructed by the Government of the Republic of Indonesia. At the centre of this project is a satellite system which will provide the links necessary to cover Indonesia's vast and fragmented territory of over 3,000 islands.

The contract calls for the construction of ten complete transmitting stations, and the updating of five regional television studios. The transmitter stations will be installed on the two largest islands—Sumatra and Kalimantan.

In all, ten 10kW, four 5kW and six 1kW transmitters will be supplied. The equipment in each package also includes the mast and antenna system, program input and test equipment, microwave links, studio equipment, and diesel electric generating and distribution equipment.

The colour TV set as a daily newspaper

The TV set is potentially an ideal carrier for "hard fact" information, displayed as a large-print magazine page. In Britain, the technology to make such displays a reality has already been developed and test transmissions are now being conducted by the BBC and the IBA (Independent Broadcasting Authority). But does the consumer want, or need, to receive information in this way?

by ADRIAN HOPE

Since last September, when the British Government announced a two-year experiment, the BBC has been transmitting 24 pages of continually updated news and information on the BBC-1 television channel seven days a week. By now 50 different pages of information have become available and, before long, 100 pages (the full quota envisaged) will be on the air alongside BBC-1. The Independent Broadcasting Authority has also carried out similar experiments. And although there are as yet no routine transmissions on the scale of those offered by the BBC, this summer London Weekend Television will join with Independent Television News to provide a news text service.

To see how these transmissions affect (or, rather, fail to affect) conventional TV sets, you need only misadjust the height control of a British TV receiver to bring down the top of the picture into view. A flashing series of dots along the top two picture lines is all you will see. This is enough for a set with a suitable digital decoder to select and reproduce any one page of information transmitted as an alternative (or as a superimposed addition) to the scheduled TV program.

The test programs currently being transmitted are the result of research work carried out independently by the BBC and the IBA, but merged during the past two years into a single system conforming to a Unified United Kingdom Standard. This standard is applicable only to 625-line transmissions, and thus cannot be adopted without considerable modification in 525-line countries, such as the United States.

Research assistant Elizabeth Donnelly displays the controls used to summon-up a "page" of Ceefax information on a TV monitor. A stock market report is shown.

It is, however, currently being evaluated and tested in Sweden, Finland, Belgium and West Germany. There is thus a good chance that the UK standard will be adopted, with minor modifications, throughout at least part of West Europe (France is moving towards the adoption of a cable standard). Widespread European adoption of a unified standard system will inevitably make life easier for the manufacturers and cheaper for the consumer.

The BBC transmissions go under the banner "Ceefax" (seeing facts); the IBA transmissions are labelled "Oracle" (optical reception of announcements by coded line electronics). Although the names may be different, the systems are now identical. Thus, although both the IBA and the BBC will continue their traditional competitive rivalry by transmitting independent services, both services will be available for reception on one and the same decoding set.

To understand the working of the UK standard system (usually referred to as "teletext" or "teledata"), it is necessary first to understand not only the main assumed requirements of a data consumer but also the practical difficulties involved in meeting these requirements. It is, of course, essential that the data be available as an alternative to routine programs. But provided that the data display is clearly legible and can, if the viewer requires, be retained on the screen for a considerable length of time, there is no need to provide a hard copying facility.

There should also be sufficient data available to make the system worthwhile, but not so much data crammed on to the screen at any one time as to make it illegible or confusing. And it follows that there must be a facility for the viewer to choose between different transmitted pages, or an automatic turnover from one page to the next, or preferably both.

Fortunately for data engineers, conventional TV transmission relies on interlacing. Thus, instead of 25 separate pictures of 625 lines each being traced out on a TV screen each second, every

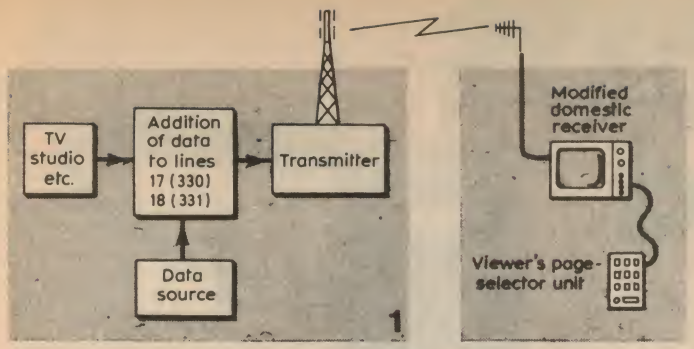


Fig. 1: block diagram of the basic "teledata" system used for Ceefax and Oracle transmissions.

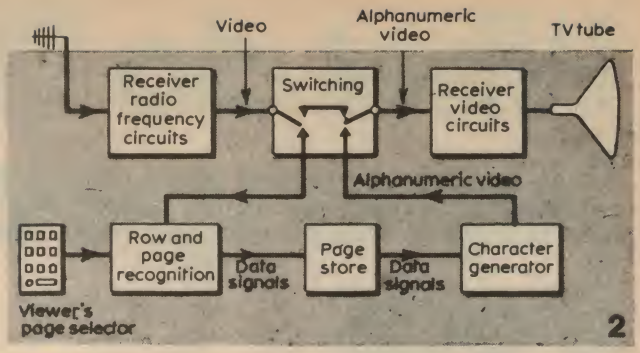


Fig. 2: block diagram of teledata receiver circuitry. The viewer may select any one of 100 pages.

625 line series is transmitted as two separate patterns (fields) each of 312½ lines. These two patterns are transmitted alternatively and interlaced to provide the effective equivalent of 50 separate pictures per second, and thus flicker-free viewing. Because the electron beam spot returns to its start position by taking a short cut route across the screen, there is a blanking period of just over one millisecond and a few lines of the picture (at the top of the screen) are not used to carry normal program information.

Some of these lines are already used for test signal injection, and others must be left blank or they may interfere with the normal working of a receiver. But lines 17 and 18 on the first half of the scan and lines 330 and 331 on the second (interlaced) half of the scan provide an ideal carrier for data information.

There is, in theory, no reason why a full 625 line data picture should not be assembled in building-block fashion by the use of these few available lines as they occur. But clearly if the page is to be displayed as an entity (rather than as one or two lines flashed at a time), all the lines must be entered into a store and read out when the store is full. Unfortunately, the store necessary for a notional page of 1,000 characters would need to have a capacity of 360,000 bits.

The UK standard approach is entirely different. Although it uses the pairs of lines left available by the blanking period, it uses them only to carry signals which trigger a permanent store of characters. In this way the notional page of 1,000 characters can be regenerated using only 7,000 bits. Hence only seven kilobit (7k) storage is necessary. As an additional bonus, whereas it would take over 12 seconds to transmit a full 625 line page picture according to the line building system, it takes only a half second to transmit a similar page according to the store triggering system.

It was decided that the UK system should take 100 pages as the maximum size for the magazine to be transmitted. Thus a viewer has the option of choosing any one of 100 different pages of information. It was also decided that each separate page should be divided into 24 rows of 40 characters, a total of 960 per page. The pages are transmitted in the sequence 1, 2, 3 . . . 100.

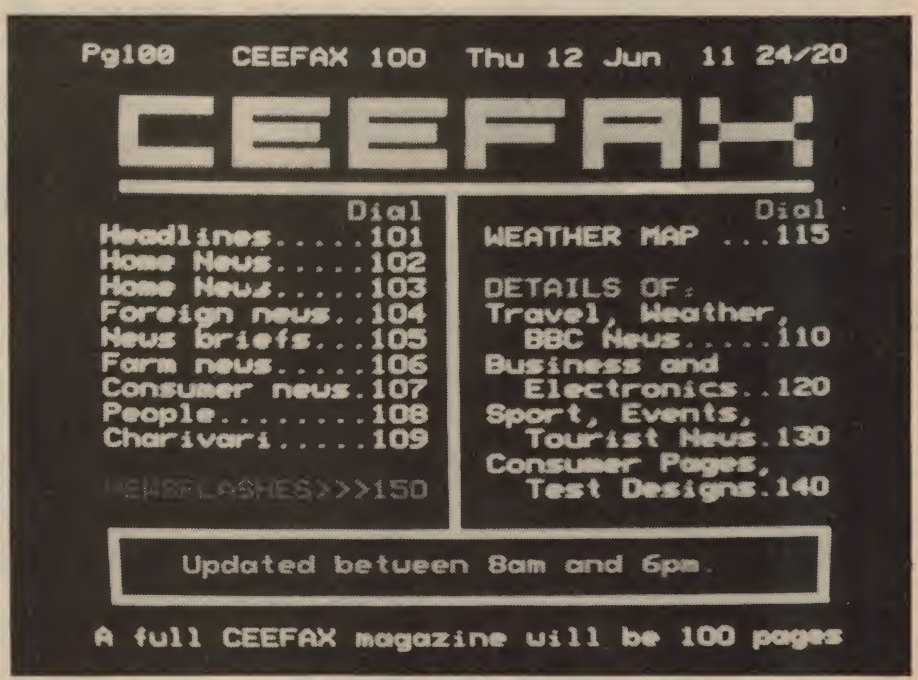
As shown in Fig. 1, normal studio program has teledata added to lines 17 and 18 and 330 and 331 from the data source and is then transmitted exactly as before. The data added is in two types: a stream of 8-bit groups which define and help the receiver recognise the row and page, and a stream of 8-bit groups which carry the characters to be displayed in each row. The bit rate is 6.9375 megabits per second.

Each page-header row of information signals include the word Ceefax or Oracle, the page number and the current clock time. Other page rows simply contain character information. But every single row (be it page-header or normal page row) commences with synchronisation and information pulses which bring the receiver clock into step with the transmitted data and determine the page number and position of the line.

The receiver RF circuits (see Fig. 2) detect the video signal in the normal manner and acquire from this signal the teledata digital information. This is routed to a row-and-page recognition circuit, which is under the control of the viewer's page selector. The receiver compares the transmitted digital information with that punched into the page selector (usually a calculator type keyboard) and ignores all the unwanted pages.

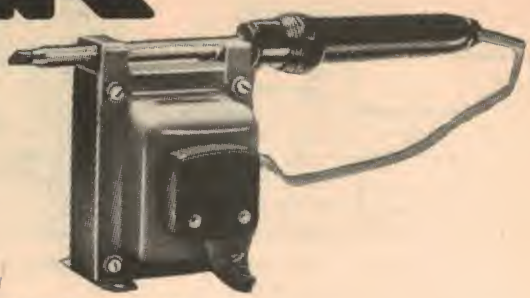
When the digital information contained in the beginning of the header-row of a page matches the command punched into the selector, the data signals for the selected page are fed to a page store memory. This memory, usually a random access memory (RAM) or a shift register, must have a storage capacity of 6,720 bits to accommodate a full page (960 characters less "parity" bits for error detection which need not be stored).

It is normal to update the store continually at each fresh transmission of the page. This helps compensate for errors in reception and also enables the capture and display of any new information as it is fed into the page via the transmitter.

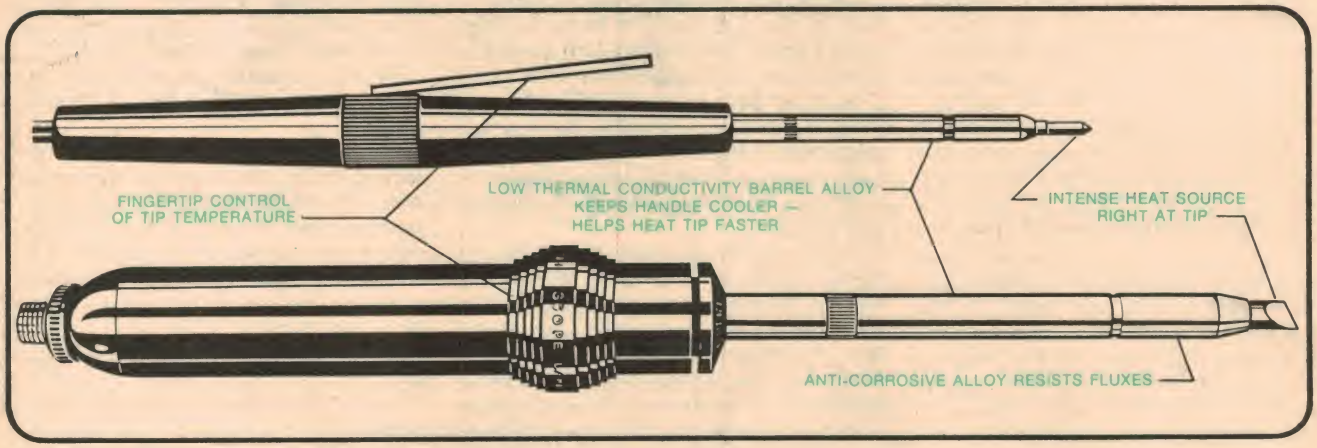


This photograph should give some idea of the content of a typical Ceefax magazine. It shows the Ceefax index of a magazine transmitted last June.

What do SCOPE Superspeed Irons do best?



SCOPE TRANSFORMER
This transformer is specially designed to provide a safe low voltage power source for Scope Superspeed Irons (and Vibroscope etching tools).
An earthed isolation shield prevents capacitive coupling with possible voltage leaks.



1. **Provide intense heating power:**
The patented heating concept located right behind the tip provides tremendous heat output to get the iron hot fast; then keeps the temperature under your control to complete every joint faster.

2. **Let you control the power:**
Should you encounter a heat sink which would rapidly drain away tip heat (e.g. thick metal or a need for plenty of molten solder) your finger switch provides another burst of heat to keep the copper tip at correct temperature. Normally only heavy irons have this capacity and take a long time to heat — and cool.

3. **Put this heating power right at the tip:**
A perfect iron has its heat source right at the surface of the tip — inefficient irons have their's up the barrel. The Superspeed range generate their heat on the copper tip itself, hence the intense concentration.

4. **Lets the tip run cool when not actually soldering:**
The tip stays tinned longer and lasts much longer because it switches off when you let go the handle. This feature plus a low heat conductivity stainless barrel keeps the handle cooler.

5. **One iron replaces several:**
With normal irons, you need several different sized irons to cope with various jobs and avoid the risk of dry or weak joints. Scope has designed an iron that does the work of any other iron from 10 watts to 150 watts.

SUPERSPEED USER SELECTION DATA

	Superspeed	Mini Superspeed
Low heat conductivity barrel	Yes	Yes
Non-corrosive barrel	Yes	Yes
Weight (without leads)	100 grm	50 grm
Heating up time for 40/60 solder from cold	5 sec.	5 sec.
Heating up time for aluminium solder from cold (450°C)	14 sec.	12.5 sec.
Heating up time for hard silver solder from cold (630°C)	32 sec.	29 sec.
A conventional iron to do the same work would need to be—	up to 150W	up to 75W
Diameter of barrel	9.5 mm	6.4 mm
Choice of copper tip shapes	Yes	No
Cable lugs fitted	Yes	Yes
User Preference Guide:		
Electronic Service work	TV with vac. tubes	Solid State equipment
Electronic and HI FI hobbies	2nd pref.	1st pref.
Electricians and Linesmen	1st pref.	not recommended
Home Handymen and Farmers	1st pref.	not recommended
Model making — Mechanical Hobbies	1st pref.	2nd pref.

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Ceefax . . .

Here a research assistant is entering data into the Ceefax system by means of a video display unit. Ceefax is in colour and on air during all BBC-1 transmissions.

The page store supplies data signals characteristic of the stored page to a character generator. To ensure that the page is displayed continuously (rather than as a brief flash), the supply of data signals to the character generator from the page store does not erase the information held in the page store.

The character generator is a read only memory (ROM) and produces video signals according to the instructions it receives from the page store. These are fed to the receiver video circuits and cathode ray tube to create the visible display. The video signals from the character generator cause the display of alpha-numeric characters on the TV tube by means of seven-by-five dot matrix.

It is also possible to use the character generator to build up a drawing or diagram (such as a weather map) from individual dots or blocks. Further research here is being carried out by the IBA, which is currently working on the computerised generation of digital information from analog drawings.

Various other facilities are available as part of the UK system—including individual colouring of selected pieces of information on a page, flashing of important messages, superimposition of some messages over normal programs, and automatic display of selected information at a predetermined time. What this means in practice is that on a weather map some temperatures may be coloured in red, some in green and some in blue (up to six colours are available). Likewise one or two all important words of a full page may be made to flash on and off to draw a viewer's attention to them.

Where a viewer wishes to watch data messages as well as a television program, either to be kept up to date with the news or when sub-title captions are being transmitted along with a foreign film, the data may be superimposed over a part of the normal picture being transmitted. The automatic time facility enables the viewer to have the stock exchange prices flashed to him at the moment when they are first transmitted, and even to have the receiver decoder capture and store the information for him if it is first transmitted while he is away at the office.

The Ceefax and Oracle demonstrations to date have been impressive and have left no doubt that the system really works. The screen information is clearly legible—and will be so to any viewer who can receive a reasonably ghost-free signal of adequate strength. However, there are currently legions of television viewers who sit in apparent contentment watching atrocious pictures on sets that are ill-adjusted and badly served by inadequate aerials. These viewers will not receive data displays of equivalent (poor) visual quality; they will simply receive no usable teledata displays whatsoever. Because the characters are generated inside the TV set by the ROM, any characters that are displayed will be clear and legible. But the data decoder will not suffer an inadequate or ghosted signal gladly and, under such conditions, will simply produce complete gibberish or nothing at all.

The only really major unsolved problem now is whether the manufacturers and public will show any enthusiasm for the system. So far only a few prototype sets are in use, and anyone wishing to watch the current transmissions will need to place a special order for a set with one of the major British manufacturers, such as GEC. They must also expect to pay about £500 extra for the decoding facility and this puts the current price of a colour set and decoder at around £800.

As large-scale integration (LSI) techniques in electronic microcircuits are brought to bear on the memory stores used in the decoder, the hardware prices should fall. A research study compiled recently by Timothy Johnson (Teletext: data transmission by television, Financial Times Business Enterprises, £80) suggests that receivers should be available in quantity by the end of the decade and will then cost between £120 or £150 over the normal price of a TV set. But the report also suggests that the decoder cost should then continue to fall to something under £60 in the 1980s.

But no manufacturer will spend the necessary millions of dollars on the LSI circuit development unless he is convinced there really is a market for the product. And until the cost to the consumer is brought down by large-scale integration, few people are likely to buy sets and provide the manufacturers with a barometer of interest.

There are two possible ways of breaking this vicious circle. If a simpler memory system was incorporated in some sets to reproduce simply one-line of a page at a time, the data information already being transmitted could be made more cheaply available to the public. The Japanese Telescan system uses (of necessity) one-line "crawling" messages, simply because there are over 2,000 characters in the Japanese alphabet and no memory can reasonably cope with all these at once. There seems to be no reason why a compromise memory should not be used to provide crawling one-line messages cheaply on the British system.

It also appears to have occurred to no one so far that public opinion on Ceefax and Oracle could be readily sounded by providing everyone with a free sample data page service now. For long periods of time during the day and night all the BBC and IBA transmitters lie idle or transmit only test material. If some of this idle time were turned over to transmitting Ceefax and Oracle pages as normal programs, the public could tune in to, say, BBC-1 for a newsflash page, to BBC-2 for weather, and to commercial TV for sports results. It would cost very little to transmit these pages because both the BBC and IBA already have data teams working full time (the BBC team is 10 strong). And it would cost the viewer nothing but the effort of switching on his set outside peak hours.

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I enclose my cheque, postal/money order to the value of $ . . . . . .

Electrically guided driverless vehicle system

The increasing road toll on motorways has given rise to a great deal of public concern in recent years. Faced with this problem, British motor traffic researchers are examining several futuristic concepts aimed at cutting the toll. One of the most interesting developments in this field is a fully automatic driverless vehicle system developed at the Transport and Road Research Laboratory at Crowthorne, Berkshire.

by ALAN DAWLISH

When scientists at the Road Research Establishment Laboratory in Crowthorne, Berkshire, were faced with the problem of overcoming driver fatigue, they hit upon a unique solution—eliminate the driver!

"Driver fatigue only occurs when the driver lapses into a false sense of security caused by the monotonous drive," explained a TRRL (Transport and Road Research Laboratory) scientist. "If the driver were to travel for long hours in built-up areas the scenery helps to keep him alert. Motorways are fatigue death traps!"

In research aimed at overcoming this problem, scientists at the TRRL adapted a 42 seat Daimler coach and a Ford Cortina car in such a way that the two vehicles are now regularly seen carrying passengers from one end of the research centre to the other (a distance of several kilometres) without a driver. Both vehicles are completely automatic.

Basically, the system operates by means of a road located guidance cable and a vehicle-borne electro-mechanical system to convert signal commands into vehicle response. Two sensors on the front of the vehicle detect the magnetic field produced by AC current flowing in the guidewire, the difference in signal levels representing how far the centre of the vehicle is from the guidewire. These signals are used to derive an error voltage which, in turn, drives an electric motor to control the steering.

Vehicle speed is pre-set to a maximum before the journey begins, and is controlled in much the same manner as the steering. A speed command from the road cable in the form of a voltage is compared with a voltage proportional to the actual vehicle speed, thus producing an error voltage. This error voltage is used to derive error voltage signals of varying mark-space ratio which are fed either to the throttle or brake actuators, increasing or decreasing the vehicle's speed as required. Gear changing is completely automatic.

A problem of vital importance in automated systems such as this is that of maintaining a safe distance between vehicles or other hazards. The system used here is an infra-red "radar" unit fitted to the front of the vehicle. This unit consists of a Harrison-Fraba Optical Detector which emits a modulated infra-red beam. Signals reflected back to a photocell detector by obstructions on the road ahead are used to activate the braking and gear changing mechanisms.

"The idea we have for the bus is that it could be used firstly along motorways," a TRRL scientist said. "The manual override system would be used to take the coach through the town collecting passengers. Then as the coach reaches the motorway linkage the driver lines the bus up over the buried cable, programs the speed according to motorway traffic conditions, and leaves the coach. On closing the doors the coach starts its journey without the driver. At the other end of the motorway the coach stops. There another driver is waiting to take the bus to the town and drop the passengers off."

According to the TRRL, one 130 km stretch of motorway in Britain is already fitted with buried cable. In reality, then, the days of the driverless vehicle might not be all that far into the future!

Photograph at left illustrates the relatively few modifications to the driver's compartment. Above, scientist s monitor the progress of the automatic bus over a two mile test route.

Einstein's Theory of General Relativity and . . .

THE DETECTION OF GRAVITY WAVES

The results of Einstein's Theory of General Relativity are profound, opening up new understandings of the physical laws which govern the universe. This article takes a brief look at some of the implications of Einstein's theory with regard to the laws of gravity, and discusses one of the most fascinating challenges facing scientists today—the detection of gravity waves.

by J. BRIAN DANCE, M.Sc.

The phenomenon of gravitation has fascinated philosophers and scientists throughout the ages. Indeed, the subject has quite an interesting history, linked closely as it is with the development of astronomy. Although Einstein's work is now widely accepted, our present ideas have evolved over centuries, and new theories are still being formulated at the present time.

One of the first attempts to explain why objects fall was made by the Greek philosopher Aristotle. He suggested that objects fall towards the Earth because that is their natural place to be. These days, of course, we would say that this sort of statement is no explanation at all.

In early times it was thought that the Earth was at the centre of the universe because the Sun, the stars, and other planets seemed to move around it in circles. It was not until 1543 that Nicholas Copernicus, after 45 years of study, was able to conclude from his observations that all the planets, together with the Earth, were moving in near circular paths around the Sun. This was an amazing feat for at that time Copernicus did not have the use of a telescope.

Following Copernicus, Johan Kepler (1571-1630) analysed the motions of the planets in great detail, establishing that their orbits were, in fact, elliptical. However, his most important conclusion related to the connection between the period of revolution of each planet and its distance from the Sun.

Kepler found that the square of the period of revolution of a given planet is proportional to the cube of its average distance from the Sun. It was from this law that Sir Isaac Newton (1642-1727) deduced the Law of Universal Gravitation, one of the most important developments in the history of science.

The Law of Universal Gravitation simply states that the gravitational force between two objects is proportional to the product of their masses and is inversely proportional to the square of the distance between them. Newton was the first person to appreciate that, just as the Earth attracts all objects, all objects attract one another.

Newton's work was vitally important. He not only explained why the Moon circles the Earth, but also why the planets circle the Sun obeying Kepler's Laws of Planetary Motion. In addition, his work was to lead to the discovery of two new planets. When the orbit of the planet Uranus did not seem to be obeying the Law of Universal Gravitation, searches were made for other planets which could be effecting it. This resulted in the discovery of Neptune in 1846 and of Pluto in 1930.

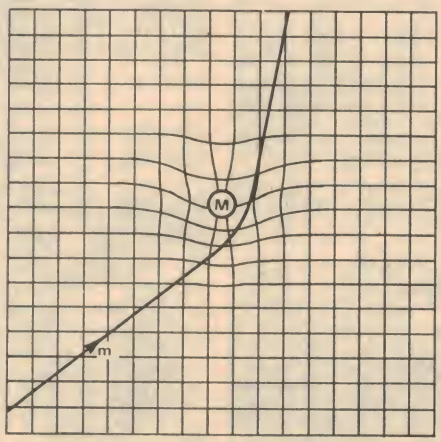


Fig. 1: curvature of space-time by a massive body M. The influence on the trajectory of a small particle m is shown.

In spite of its simplicity, Newton's Law of Gravitation did not provide an explanation as to why objects of differing masses should have the same acceleration for a given gravitational field. This problem was not understood for some 250 years after Newton's work, until Einstein published his Theory of General Relativity.

Although the Theory of General Relativity is mathematically complex, we can nevertheless gain some insight into Einstein's ideas in the following way. If a person is in a lift which is falling freely under gravity, the effect inside the lift is as if gravity has disappeared. Objects will no longer fall towards the floor of the lift.

Similarly, gravity will apear to be zero inside a space vehicle which is travelling without its rocket motors operating. However, as soon as the vehicle is accelerated by its motors, objects again fall inside the vehicle just as though it was on the surface of the Earth.

Einstein showed that objects inside a vehicle undergoing acceleration behave in exactly the same way as if they were in a gravitational field. In his theory, a gravitational field is exactly equivalent to the acceleration of the whole system in which one is performing the experiments. This acceleration will be constant for all objects within that system.

Einstein's theory thus explains why objects of differing masses accelerate uniformly in a gravitational field, and why the weight of an object is directly proportional to its mass. This proportionality was checked experimentally by Baron von Eotvos of Hungary about 1900. More recently Vladimir Braginsky, working in Moscow, has checked it to within a few parts in a million million.

Einstein explained the effects of gravitational forces in terms of a curvature of space-time. If a massive body M

is present, the space around it can be thought of as being distorted in the way indicated in Fig. 1. A small particle passing in the region will follow a path which is a straight line until it enters the hollow region of curved space-time near M. Its path is then changed, as shown. In addition, the particle would travel faster as it entered the hollow around M, and would slow down again as it moved away from M (just as though it were attracted to M according to Newton's theory).

Although Einstein's theory provides us with a better understanding of the nature of gravitation than Newton's theory, it is far more complex in mathematical terms. The results of Newton's theory approximate to those of Einstein's and are considered adequate for many purposes. However, there are three main phenomena where the results do differ, and these phenomena can be used as a test of Einstein's General Theory.

The first of these phenomena concerns Einstein's prediction that a ray of light from a distant star which just grazes the surface of the Sun will be deflected through an angle of 1.75 seconds by the gravitational field of the Sun. In 1919, Eddington and others photographed the Sun during an eclipse when several stars "near" the Sun were visible. They found that the images of these stars were indeed displaced from their normal positions, as found by photographing the same stars at night.

However, the positions of the stars could not be measured as accurately as the experimenters would have wished. Nevertheless their results were strongly in favour of Einstein's theory.

A second test of Einstein's theory concerns the advance of the perihelion of the planet Mercury. This planet moves around the Sun in an elliptical orbit with the Sun at one focus. The point at which the planet is closest to the Sun is known as the perihelion, and it advances in the same direction as that in which the planet moves in its orbit, at about 5,600 seconds of arc per century.

Most of this shift is due to the gravitational effects of other planets on Mercury. But even when all these effects are allowed for, there is still an unexplained advance of 43 seconds of arc each century when using Newton's theory.

Initially, it was suggested that the presence of a new planet (named Vulcan) between Mercury and the Sun could explain this effect. However, Einstein's theory was to subsequently predict, almost exactly, the additional observed advance of 43 seconds per century. In 1967, the remaining discrepancy was accounted for when it was suggested that the oblateness (flattening at the poles) of the Sun could cause a shift of a few seconds of arc.

Einstein's theory also postulated that photons of light would lose energy as they leave a region with an intense gravitational field. This results in a decrease in the frequency of the light, and is thus known as the "gravitational red shift."

Professor Joseph Weber working on one of his gravity wave detectors. Note the ceramic strain detectors fastened around the circumference of the cylinder.

Theoretical calculations show that the effect is extremely small for gravitational fields of normal magnitude, and it was originally thought that the theory could be confirmed by searching the intense gravitational of white dwarf stars. However, gravitational red shift has since been observed and measured in gamma photons climbing against the gravitational field of the Earth. These latter measurements make use of the sharply defined frequencies provided by the Mossbauer effect, and the results agree well with Einstein's predictions.

Perhaps one of the most interesting aspects of Einstein's theory concerns the prediction that when massive objects are accelerated, they radiate gravity waves. By way of illustration, this may be compared to the fact that accelerated electrons in a radio transmitting aerial radiate electromagnetic waves. As with electromagnetic radiation, theory predicts that gravity waves travel at the speed of light (3×10^8m/sec).

If one wishes to detect any other form of wave, one would normally make the wave in the laboratory and then build suitable detection apparatus. However, the amount of energy converted into gravity waves by any system which could conceivably be accelerated on Earth would be so small as to make detection impossible. One can therefore only build a gravity wave detector and hope that waves are being emitted from massive objects in the universe with an intensity which is great enough to be detected.

Professor Joseph Weber of the University of Maryland, USA, has been planning experiments to detect gravity waves since 1958. In 1969 he produced very convincing evidence that he had detected gravity waves coming either from the centre of our galaxy or from the opposite direction.

Unlike other forces in nature, gravitational radiation shows very little tendency to interact with matter, and is therefore extremely difficult to detect. Gravity waves easily pass through massive bodies such as the Sun, and once such a wave has started on its journey it is most unlikely that it will be absorbed anywhere in the universe.

However, if one has two separated masses, they will undergo a very small acceleration relative to each other if a gravity wave passes through them in a suitable direction. This principle forms the basis of the detectors constructed by Weber for his experiments.

A typical gravity wave detector employed by Weber consisted of a solid

THE DETECTION OF GRAVITY WAVES

aluminium alloy cylinder measuring some 1.5m in length and 1m in diameter. Weight was approximately 3½ tonnes. The cylinder was suspended by a wire wrapped around its mid-point, and the whole placed in a steel vacuum chamber in order to minimise damping and to eliminate noise caused by air molecules striking the cylinder.

Set up in this manner, a gravity wave travelling with a component perpendicular to the axis of the cylinder would excite mechanical oscillations in the system. In order to detect these oscillations, Weber attached ceramic piezo-electric transducers around the circumference of the cylinder at its centre where the strain would be greatest. As may be readily appreciated, this system is most sensitive to radiation approaching perpendicular to the axis of the cylinder, and insensitive to radiation approaching parallel to the axis.

The detectors built by Weber were also sensitive only to waves which have a frequency close to 1660Hz—the resonant frequency of the cylinder. Detection capabilities were such that waves having an amplitude down to 10^{-13}mm – less than the radius of a proton – could be detected.

Weber set up one such detector at the University of Maryland and another at the Argonne National Laboratory about 1,000km away. He found that, on average, the two cylinders oscillated simultaneously approximately once in every 24 hours. Seismic disturbances, cosmic rays, etc., might cause one detector to oscillate, but Weber showed that the chances of both oscillating due to these effects were very small.

An analysis of Weber's observations revealed that coincident oscillations in the two detectors did not occur more frequently at any particular time of the day. This indicated that the source lay outside the solar system.

However, when the number of coincident oscillations of the detectors were plotted against sidereal time, it was found that a maximum occurred whenever the direction of maximum sensitivity was on line with the centre of our galaxy. (Sidereal time is measured by the Earth's rotation relative to the stars.) This maximum occurred twice per sidereal day—as would be expected, since the detectors were just as sensitive to radiation coming through the Earth as that reaching the detectors directly.

On the basis of available evidence then, it would seem that Weber was detecting gravity waves. However, it should be noted that intensive efforts by workers in other countries to repeat Weber's observations have failed to produce convincing results.

Various detectors being prepared at present employ the basic technique used by Weber, but some should be much more sensitive. For example, workers at Stanford University and Louisiana State University are preparing an experiment in which a detector weighing over 5 tonnes will be cooled to a temperature approaching absolute zero and suspended by superconducting magnets. Similarly, a group at the University of Rome plan to cool a 5 tonne aluminium bar to within 1/10°C of absolute zero in an experiment that will enable them to detect vibrations of one thousandth of the amplitude of those detected by Weber's apparatus.

Others are using an interferometer to measure the difference in path length between two or more loosely suspended bodies, since the difference in path length should be affected by gravity waves.

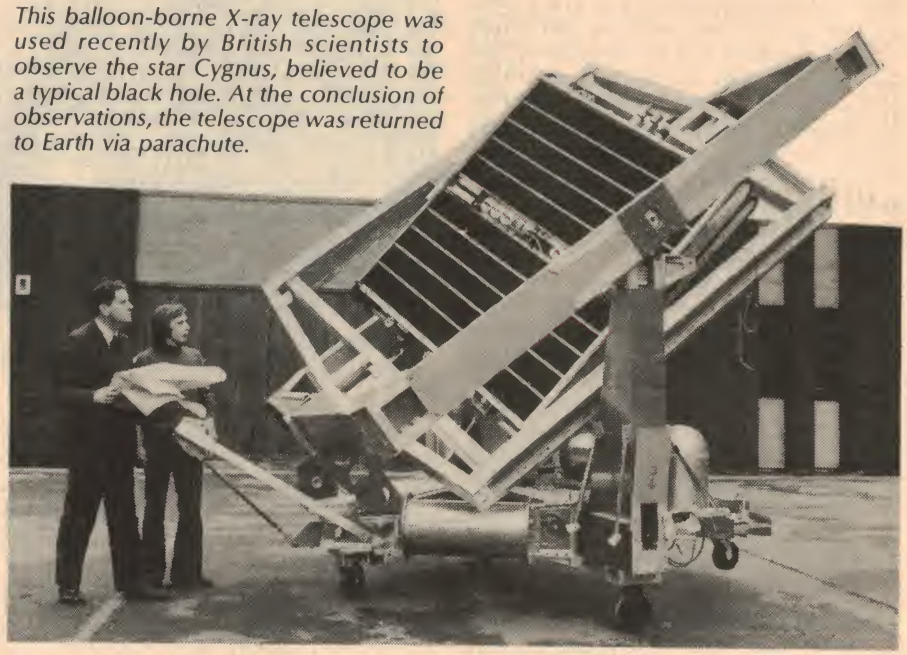
On a much larger scale, it had been suggested that the Earth could be used as a detector of gravity waves. However, the effect of such waves would be masked by seismic and meteorological disturbances. The Moon is much quieter, and the Apollo 17 crew set up equipment designed by Weber which is now returning information to us. This equipment is sensitive to lower frequencies than Weber's aluminium cylinders.

If the pulses detected by Weber do consist of gravity waves emitted from near the centre of our galaxy, the amount of energy emitted must be quite fantastic. Such an amount of energy could be generated only by the acceleration of bodies having approximately the same mass as the Sun.

On the other hand, these bodies must be quite small, otherwise the waves emitted from them would not be in phase. For 1660Hz pulses, the maximum diameter of the source would be approximately one hundredth of the diameter of the Earth. If, as one may assume, gravitational waves of higher frequencies are also emitted, the source size must be smaller still.

According to our current theories the only objects which have such a large mass concentrated in such a small volume are neutron stars and gravitational "black holes." A neutron star is formed when a star of mass somewhat greater than that of the Sun collapses under its own gravitational field and undergoes a supernova explosion. Electrons and protons in the star are forced together to form neutrons, the density of the material being about one hundred thousand million kilograms per cubic centimetre—nearly as great as the density of the neutron itself. These neutron stars are the pulsars detected in 1967 by radio astronomy.

This balloon-borne X-ray telescope was used recently by British scientists to observe the star Cygnus, believed to be a typical black hole. At the conclusion of observations, the telescope was returned to Earth via parachute.



If a neutron star undergoes further gravitational collapse, a black hole is formed. The gravitational field is then so great that not even light can escape from the object. Black holes are predicted by Theory of General Relativity but, as yet, have not been definitely detected.

When a black hole engulfs a star, an enormous amount of gravitational energy could be released. However, much theoretical and experimental work remains to be done in this particular area.

Since Weber first published his results, enormous efforts have been made elsewhere to design gravity wave detectors. One can only hope that Weber's results will soon be confirmed by other workers and that the more sensitive detectors under construction will provide a wealth of new information in the coming years.

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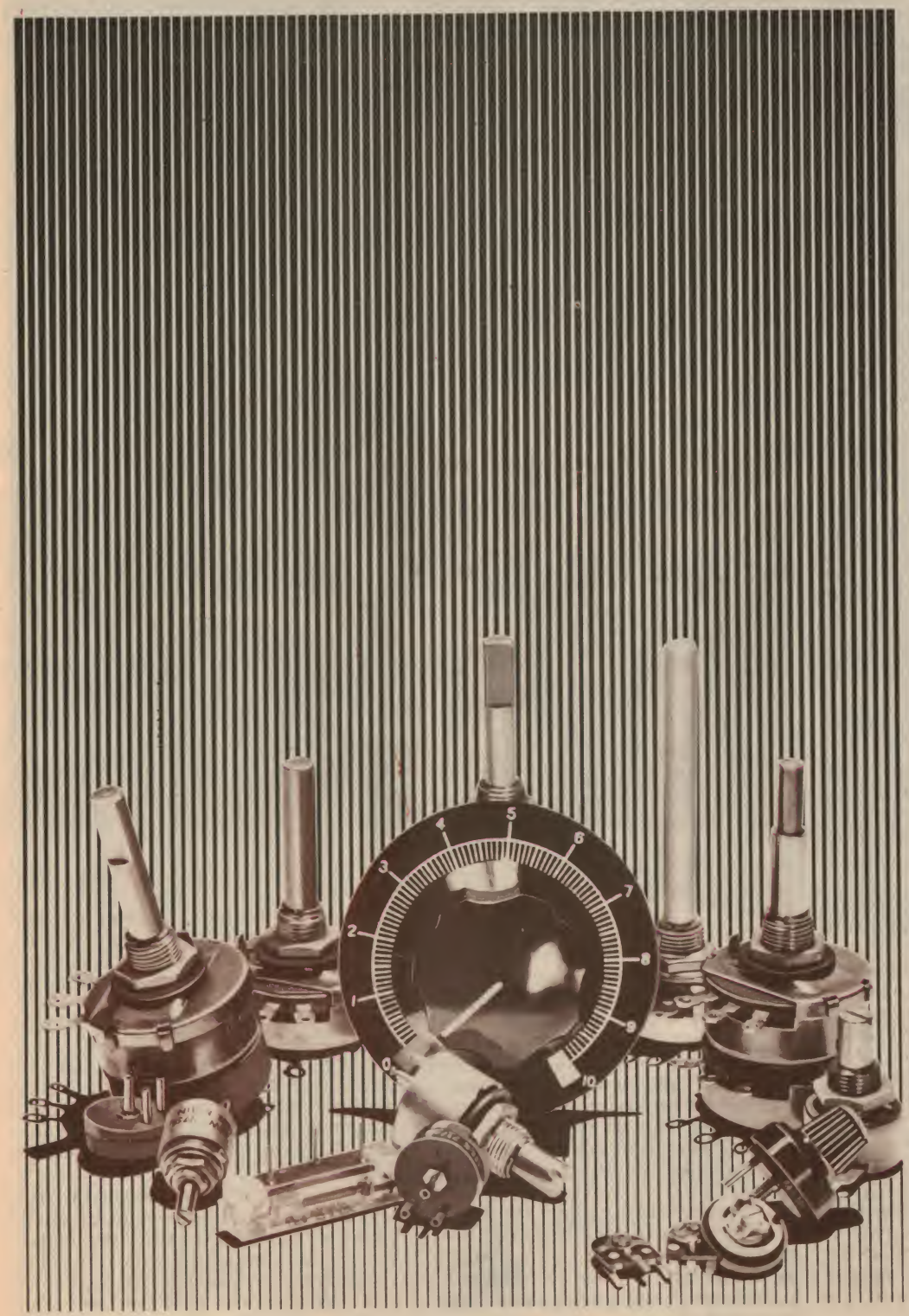

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085.P.421

Advanced radio communications for firefighting and rescue

Firemen trying to extricate survivors following the Moorgate underground rail disaster in Britain earlier this year had help from a new experimental radio designed especially for firefighting operations. Developed by the Plessey Company the new equipment should greatly enhance the efficiency of future firefighting and rescue operations, and at the same time provide an added safety factor for personnel.

In Britain, the problem of establishing reliable communications with firemen in hazardous situations has bothered firemen and the Home Office for some time. Firemen in smoke-filled buildings, for example, can become disoriented quite rapidly. Or they may be injured and require personal assistance, or may wish to direct others to ensure that the fire is fought efficiently. In these circumstances a lack of effective communications not only hinders fire-fighting and rescue operations, but also endangers the fireman's life.

In the early 1970s, Britain's Home Office gave Plessey Avionics and Communications a contract to develop a radio system that would overcome this problem. Conventional walkie-talkies operating in the VHF and UHF bands were found to be unsatisfactory. After considerable research a somewhat lower operational frequency of 3MHz was decided upon, this frequency representing the best compromise in overcoming the factors that inhibit the penetration of radio waves into steel-framed buildings and other difficult areas.

The outcome of this work was the development of a new radio communications system designed specifically for firefighting applications. Called "Figaro," for fire ground radio, the new equipment is now undergoing trials with several fire brigades in the London area.

From an operational viewpoint, the new equipment provides firefighting and rescue services with vastly improved communications in hazardous fire environments. With Figaro, communications can be fully maintained between a base station and firemen in steel-framed buildings, tunnels, mines, and similar locations. In addition, a "talk through facility" is available which permits fireman-to-fireman contact.

The safety of the rescue worker or fireman is considerably enhanced when using Figaro. He is completely mobile, unhampered by communications cables and other devices, and, in the case of personal injury or danger, can immediately relay pertinent information. Until the new system was developed, firemen had to trail telephone cable behind them if they wanted to talk to the mobile communications centre.

There are two component parts of the Figaro communications system—a Plessey 2200 battery operated portable transceiver; and a Plessey 2201 base station, also battery operated.

The portable transceiver has been designed specifically for use with standard breathing apparatus, and is carried in the pouch of a waistcoat jacket worn by the fireman. An integral loop antenna is contained in the jacket. The transmitter is voice operated—there are no press-to-talk buttons or transmit/receive switches and this, in conjunction with the use of an earpiece and a throat microphone, means that the fireman's hands are completely free.

In fact, only two controls are fitted to the portable transceiver. These are an on/off switch combined with a volume control, and a channel selector for selecting any one of three channels. Battery life is two hours, the same as the life of the oxygen cylinder used in the breathing apparatus.

The larger base station, also battery operated, consists of a double loop antenna, a transceiver, a telephone handset, and a loudspeaker facility for local control. A "confidence" tone is transmitted by the base station every second so that the fireman knows his particular unit is functioning correctly. The controls fitted to the base station include an on/off switch, a volume switch, a channel selector, and a "talk through facility" switch. Base station battery life is eighteen hours.

The new equipment proved invaluable during rescue operations following the Moorgate underground rail disaster. At Moorgate, Figaro was used to establish voice communications between rescue workers on the platform and back-up services at street level. Despite the fact that the systems used were only development models, they are reported to have worked perfectly and to have made a major contribution to rescue and clearance work.

Figaro demonstration: a fireman is fitted out with Figaro, while an officer (left) operates base station equipment.

Ideal for beginner or experimenter:

A simple gain tester for silicon transistors

Here is a low cost way of checking most modern silicon bipolar transistors for DC current gain. It doesn't need a built-in meter movement, nor an accurately known or regulated power supply.

by F. G. CANNING*

For anyone who does much experimental or service work involving transistors, a cheap and quick device for testing their DC current gain (usual symbol hFE) is a very useful thing. When checking new purchases and also before putting a transistor into service for the first time, it is comforting to know that it is not only free from open or short circuits but is also giving something like the useful gain predicted by the published data for that type.

It is also valuable when looking for those transistors which, though not apparently dead, are still responsible for failure of equipment to operate properly. For the man who buys surplus units from disposals stores at low prices such a tester is really essential, for his purchases may well include a percentage of transistors whose effective gain is well below par—which is not to say that they cannot be used for suitable purposes provided one knows what to expect.

The tester described here will give a reasonably accurate measurement—usually on the pessimistic side—of the working gain of most silicon transistors except the high-power types used for large amplifier output stages. It will also give somewhat less-accurate but still useful and reliable measurements on most modern germanium transistors of the low-and-medium power kinds. Gains ranging from 5 to 1000 or more, in two overlapping ranges, can be read off directly from two scales.

If you have an ordinary Volt-Ohm-Milliammeter of reasonable sensitivity, preferably 20k/volt or better, the only additional parts needed are a couple of carbon potentiometers, three carbon resistors, a pair of small diodes of almost any kind and one or two slide switches. Any voltage supply of, say, 4½ to 9 volts will do and it is not necessary to know the voltage exactly; 5 or 6 volts is convenient and can come from any small battery or from a power supply unit if available. Fig. 1 shows the circuit.

*30 Back Beach Rd, Portsea, Vic. 3944

PARTS LIST

- 1 *Carbon potentiometer, 50k (see text)*
- 1 *Carbon potentiometer, 1M (see) text)*
- 2 *Carbon film resistors, 1k, ¼ watt, 10%*
- 1 *Carbon film resistor, 1k, ¼ watt, 5%*
- 1 *Fixed capacitor, .001uF or more.*
- 2 *Small diodes, germanium or silicon (see text)*
- 1 *Single-pole double-throw slide switch.*
- 1 *Double-pole double-throw slide switch.*
- 2 *Pin-jacks or sockets.*
- 2 *Large pointer-style knobs.*
- 1 *Transistor socket, or three small crocodile clips.*
- 1 *Multimeter, preferably 20k/volt or better.*
- *Panel, tag-strip, screws, etc.*

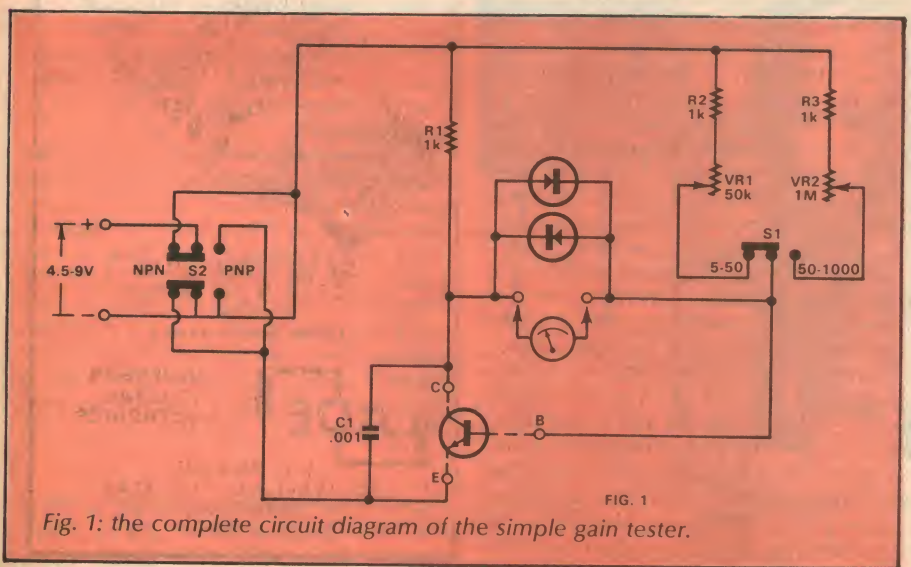

Fig. 1: the complete circuit diagram of the simple gain tester.

The simplicity of the arrangement is made possible by the convenient fact that most silicon transistors continue to show nearly their full nominal gain even when their collector voltage is reduced to the same figure as their usual base-to-emitter voltage, namely 0.5 to 0.6 volt. Fig. 2 shows the collector-current versus collector-voltage curves of a good general-purpose NPN transistor, a BC108, taken at random from the writer's small stock. Four curves were plotted, each for a different base bias current.

The DC current gain, hFE, is defined as the ratio of the collector current to the base current which causes it, or Ic/Ib, in the common-emitter circuit. In the case of this transistor you can see that with 3 volts on its collector a base current of 16 microamps gives a collector current of 5.2 milliamps, the gain therefore being 5200/16 = 325. But the curves remain reasonably horizontal right down

to a collector voltage of 0.5 volt, at which point the gain indicated is still of the order of 250. It is around this point that we shall do our measurement. The collector current under these conditions will be around 5 milliamps, which is a reasonable figure for this purpose.

Looking at Fig. 1, the multimeter, set to a low DC volts range (say 3 volts full-scale), is plugged into two sockets or pinjacks which connect it between base and collector. Its polarity and scale reading don't matter because it is used purely as a galvanometer to detect balance, which occurs at zero scale reading. The two diodes connected back to back across it are only for protection of the meter against gross overloads caused by short-circuits or wrong insertion of the test transistor. Many multimeters already have these diodes provided internally, in which case they can be omitted from the tes-

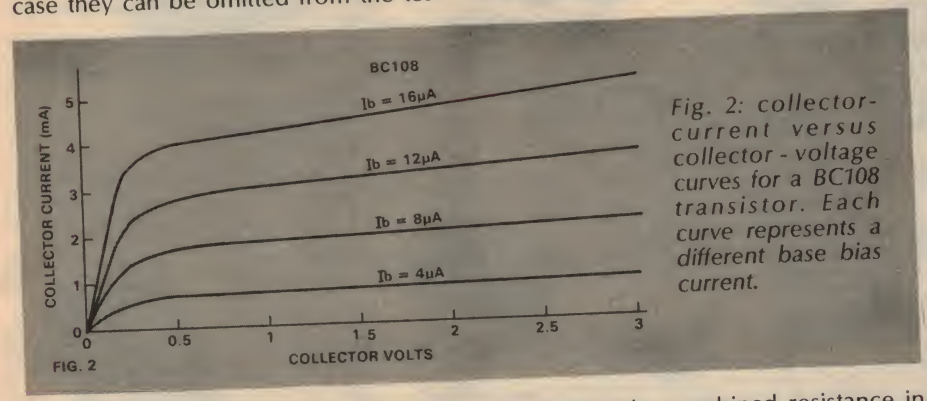

FIG. 2

Fig. 2: collector-current versus collector-voltage curves for a BC108 transistor. Each curve represents a different base bias current.

ter. The type OA5 germanium diode gives the best protection, but is fairly expensive and getting scarce; the OA91 is quite satisfactory.

The single-pole double-throw switch S1 is the range switch bringing in either VR1 or VR2 which will have scales for gain calibrated 5 to 50 and 50 to 1000 as described hereafter. The double-pole double-throw switch S2 provides convenient change-over for testing either NPN or PNP types; if desired it can be omitted and the positive and negative supply leads reversed by hand as required. Capacitor C1 could also be omitted, but its inclusion is a wise precaution against parasitic oscillation, which can sometimes happen with high-gain transistors and makes the test valueless. The actual capacitance is not important, but the capacitor should be one having low inductance and be connected by the shortest possible leads. Ceramic disc types are good.

Resistors R2 and R3 are merely limiting resistors to prevent the base being inadvertently connected to the full supply voltage, which may cause almost instant failure—and failure of a transistor is terribly permanent!

TEST PROCEDURE: Having connected the transistor, set VR1 and VR2 to their maximum resistance (which will be the maximum gain point on their respective scales). If the nominal gain of the transistor is known, the potentiometer which covers that gain is switched in by S1, and is then slowly rotated until the multimeter reads exactly zero. If the zero point cannot be found on that potentiometer the other range is switched in and the test repeated. If balance cannot be obtained on either scale the transistor is almost certainly defective, though the occasional specimen with a gain greater than 1000 may be found among the certain high-gain types.

The principle of operation is as follows. At the balance point, assuming for the moment that VR1 is in use, the collector and base voltages must be equal; i.e., the voltage drop in the base resistors Ib × (VR1 + R2) is equal to that in the collector resistor Ic × R1. Now by definition, Ic/Ib equals hFE; therefore (VR1 + R2)/R1 = hFE, the current gain. If we make R1 = 1000 ohms for convenience the current gain is equal to the combined resistance in kilohms of VR1 + R2 at the setting of VR1 which gives balance, and VR1 thus can be fitted with a blank scale pointer and calibrated at intervals of 1000 ohms to read gain directly. The same procedure applies to VR2 + R3, with calibration points at, say, 5000 ohm intervals to give a more open scale. The calibration can be done very quickly using the "OHMS" function of the multimeter if it is known to be reasonably accurate; otherwise any small resistance bridge can be used with better accuracy. The resistors R2 and R3 must be included in the calibration in each case.

CONSTRUCTION: This is in no way critical. The prototype, which has been in regular use for more than a year, was assembled on a sloping panel of insulating material measuring 5" x 3½", but something a little larger might have been more convenient. Alternatively the panel could be horizontal and mounted on feet or in a box. A vertical panel of this size is not very practical. It carries the two potentiometers, each with a blank white cardboard scale of 2¼" diameter or so, on which the gain calibrations are marked in black ink. Also on the panel are two slide switches S1 and S2, two pinjacks for insertion of the multimeter connections and a transistor socket for the unit under test. This last is a rather fiddling proposition in use when differing transistor leadout configurations are met

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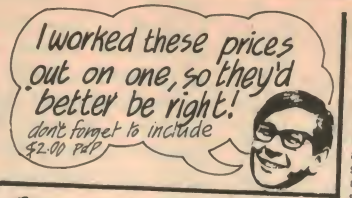

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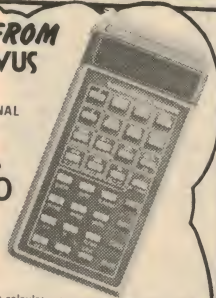

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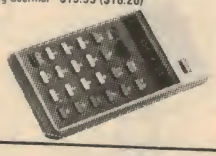

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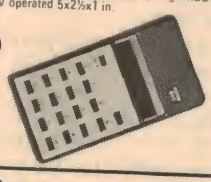

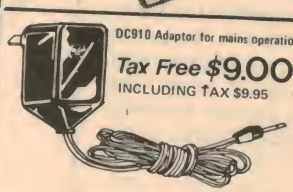

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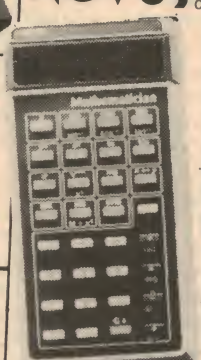

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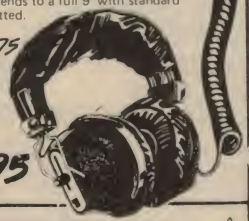
Curl-cord extends to a full 9' with standard stereo jack fitted.

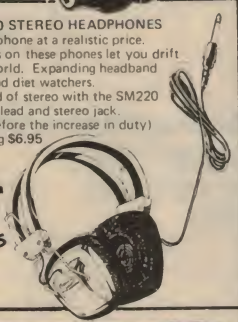
P&P $1.75



ONLY **$10.95**

MODEL SM220 STEREO HEADPHONES

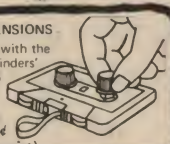
An 8ohm headphone at a realistic price.
Cushioned pads on these phones let you drift into another world. Expanding headband suits egotists and diet watchers.
Enter the world of stereo with the SM220 Complete with lead and stereo jack.
Dick's price (before the increase in duty) is an astounding $6.95



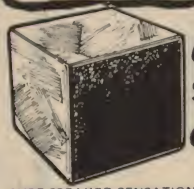
$6.95 P&P $1.75

DON'T SUFFER TENSIONS

Dick has the answer with the 'Cassette Tension Winders'
Use them to take up slack or for easy editing and repairs.



DICK'S PRICE .75¢ (per pair)



ONLY $7.50 each

CUBE SPEAKER SENSATION !

Now everyone can have Quadraphonic Sound with these fantastic little extension speakers.

Check these features:

- Scuff resistant vinyl exterior
- Modern colours
- Rugged 4" 8ohm speaker 50-20,000Hz 4watts
- Screw rear terminals
- Black fascia
- Measures a compact 128(w)x128(h) x123(d)mm

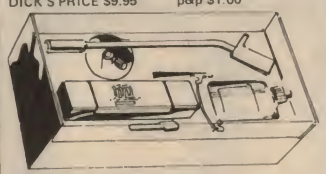
Get these handy extension speakers now for only **$7.50 each.** +75¢ p&p

Ideal as Transistor Radio extension speaker.

METROSOUND Audio Care Products

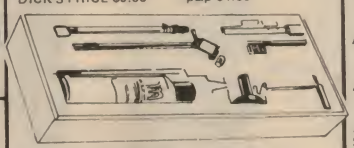
METROCARE HI FI KIT 4:
Comprising balanced arm bug + ionizer + liquid. SAVE $3.95 on this item.

DICK'S PRICE $9.95 p&p $1.00



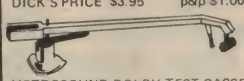
METROCARE DISCMASTER.
Dual purpose Wet & Dry cleaning arms
SAVE $2.25

DICK'S PRICE $9.00 p&p $1.00



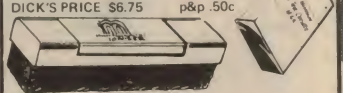
METROSOUND JUNIOR GROOVEMASTER
Clean your records the easy way.

DICK'S PRICE $3.95 p&p $1.00



METROSOUND DOLBY TEST CASSETTE
SAVE $1.35

DICK'S PRICE $6.75 p&p .50c



METROSOUND IONISER MKII
Improved model of humid, soft velvet containing a special anti static agent.

DICK'S PRICE $2.49 p&p .50¢

AM. FM STEREO/MONO

Fantastic F.M. Tuner

SAVE $10

P&P FREE

$75 $65

"Very good value indeed" Neville Williams, Electronics Australia, Feb. 75

Don't take our word for it, see the review in Feb. E A The Echosound Tuner is incredible value for money. Has separate AM and FM front ends. 10 transistors and 14 diodes. Covers FM 88 to 108 MHz AFC. 60db S/N. 35 db sepn. 600mV output AM 535 to 1605kHz, ferrite rod antenna. Features multiplex adaptor complete with built in stereo indicator 240V operation. Complete in Walnut case.
Guaranteed for 12 months

SAVE on Hi-Fi

SPEAKER SYSTEMS

CONCORD 15 ... A NEW SPEAKER SYSTEM FROM EXPO

A system using an 8" woofer and 2" tweeter in a box measuring 530mm (H) x 330mm (W) x200mm (D). Power handling rated at 15Wrms at 8ohm.

These units have a real beaut moulded black front. The cabinets have a Walnut finish. Come along to DICK SMITHS and listen to this new system.

SPECIAL PRICE $75 pair

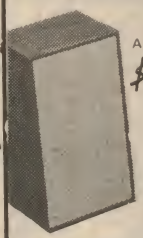
p&p Freight on.

DYNACO SPEAKER SYSTEMS

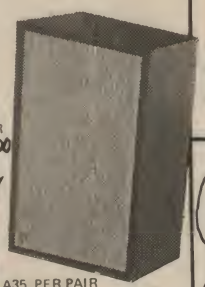
A10	15–50 watts RMS 8⅛"x15"x8"(deep) 8ohms. A bookshelf system with a superb sound.
A25	20–60 watts RMS 11⅛"x20"x10" deep 8ohms. A slightly better bass than the A10.
A35	20–60 watts RMS 12⅛"x22⅛"x10" deep 8ohms.

All three speaker systems use the Aperiodic System. This essentially means a non resonant sound. i.e. very good sound.

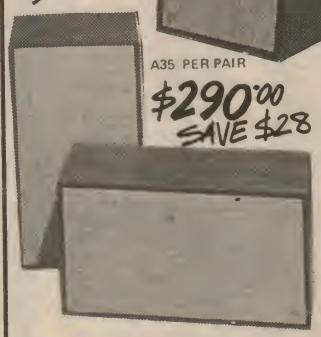
All units freight on.



A10 PER PAIR **$149.00** SAVE $9



A25 PER PAIR **$240.00** SAVE $18



A35 PER PAIR **$290.00** SAVE $28

All Dynaco speakers designed for vertical or horizontal operation!

CASSETTE SPECIALS!

We continue our superb Prices on cassettes

	Singles	5	10	20
BASF				
C60LHSM	2.50	2.50	1.85	1.55
C90LHSM	3.00	2.50	2.20	2.00
C90SMCrO2	3.50	3.00	2.75	2.50
And now HITACHI Cassettes				
C60LN	1.69	1.49	1.39	1.29
C90LN	2.25	1.99	1.84	1.69
C60UD	2.60	2.45	2.29	1.99
C90UD	2.99	2.69	2.49	2.29

For SONY enthusiasts, we have a few Sony HF Tapes left:

C60	2.75	2.50	2.30
C90	3.70	3.40	3.10

SUPER SPECIAL

CANNOT BE REPEATED OFFER ON CrO2, C60

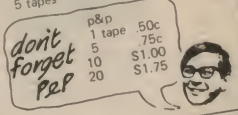
SPECIAL MECHANICS LIBRARY PACKS

Singles Price $1.75
10 or more $1.50

Dick has a few thousand only get in early on this item.

SAVE AT LEAST $2.40!!

p&p				
	1 tape	.50c	10 tapes	$1.00
	5 tapes	.75c	20 tapes	$1.75



DON'T SLING YOUR CASSETTES AROUND IN THE CAR

Dick offers an under-dash cassette holder moulded in black plastic with clear front lid. Holds ten cassettes and cases complete with bracket and labels.

This unit saves the inconvenience of searching for your favourite cassette.

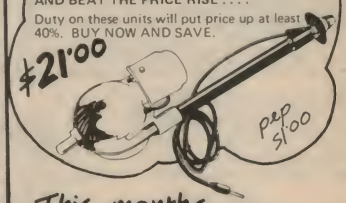
$3.99 P&P 75c

CAR ANTENNA SPECIAL

Electric antenna that goes up and down at the flick of a switch. 39" extension in 5 sections. Beat the vandals . . .

AND BEAT THE PRICE RISE . . . .

Duty on these units will put price up at least 40%. BUY NOW AND SAVE.



This months BIG SAVERS

No.	Product	List	Our Price
20	Expo TA3100 Stereo Amp	$95.00	$80.00
30	Expo CR50 Tuner Amp	$119.00	$99.00
3	Monarch SA800 Stereo Amp	$249.00	$210.00
3	Pioneer SA6200 Stereo Amp	$239.00	$199.00
1	Crown TV + Radio	$199.00	$179.00
6	AWA Stereo Cassette Decks	$125.00	$99.00

The following items were available at time of going to press and are subject to not being sold at time of publication

DICK SMITH

ELECTRONICS CENTRE 162 Pacific Highway Gore Hill
Head Office & Mail Orders N.S.W 2065 tel:439 5311
P&P 50c min telex:AA20036
Shop hours: cables:DIKSMIT Sydney
Mon-Fri 9-5.30 Sat 9-12.30

bankcard welcome here

Also at CITY 125 York St tel:29 1126 (Nr Town Hall)

and BANKSTOWN 361 Hume Hwy tel:709 6600 (Nr Chapel Rd)

JUST IN

SOLID STATE 10Watt AUTOMOBILE P.A. AMP

- All solid state - no warm-up waiting.
- Operates from 12V pos or neg DC supply
- 10Wetts (rms) output 15W maximum.
- Complete with 4foot power end 15foot speaker cords.

We've had so meny requests for a compact,reliable little P.A. amplifier.The CP-2 is just what you've been asking for. It measures only 4in x 1½in x 6½in deep.Output is a full 10W rms into 4/8ohms.Current consumption is 2A at rated output.

Frequency response (depending on input source) is from 200 to 10,000Hz.Two inputs : Mic at 600ohm and Auxiliery at 20k.Five transistor circuit with diode protected power line.Auxiliary socket is ideal for connecting to gram or transistor radio.By adjusting level of Aux input and mic volume control mixing can be acheived.Mic circuit has own tone control.

Supplied complete with cables and mounting brackets.

$36.00 p&p $1.50

Including Noise Cancelling Mic $41.40

$8.90 p&p 75c

CDM1541 NOISE CANCELLING MICROPHONE

Ideal for Amateur and P.A. use,the CDM1541 features twin inserts which are out of phase to ensure good noise cancelling. Fitted with high quality PTT switch and coiled lead.Frequency response is from 300 to 5kHz,250 to 600ohm.You could pay upto $30.00 for a unit like this.Excellent value at only $8.90

STOP PRESS.....

Even more NEW P.C.Boards

ETI 433A	active Crossover	$1.45
ETI 433B	" "	$1.45
ETI 120	Logic Probe	85c
ETI 121	Logic Pulser	85c
ETI 118	Freq Counter	$1.20c

See next Column

Don't forget P&P 50c minimum

NEW Low Cost Miniature Lightweight Relays

Ideal for any miniature equipment, instruments, model control etc. Interlaces, with suitable buffer, to TTL. Fit matrix & Veroboard 0.1 pin spacing, DIL boards etc. Measure only 15(L)x11(W)x10(H) mm Weighs 3.5 grams. Single pole double throw contacts rated at 24V d.c. 1A max or 100V a.c. 0.5A max (resistive) Two types: MZ5H 5V, 56ohm or MZ12M 12V, 320ohm. Only **$2.20**

POWER HEATSINK SAVING

The NEW TO-3 heatsink gives the greatest possible heat dissipation in the smallest space.
–Unique staggered-fin design gives a high air to metal ratio –Pre-punched to suit TO-3 cases –Black anodised finish. –Thermal rating approx 5°c/watt. –Measures only 5cm square by 2.5cm high. GRAB THESE AT ONLY **75¢ each**

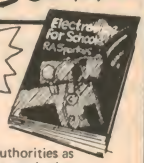
October SPECIALS

PILLOW SPEAKER
FITS INTO ANY STANDARD 3mm EARPHONE SOCKET & GIVES YOU PERSONAL LISTENING WITHOUT THE DISCOMFORT OF AN EAR-PHONE'. ONLY **$2.00**

T.V. ANTENNA CLIP SPECIAL
CHROME PLATED CLIP WITH INSULATED HAND GRIP FOR QUICK CONNECTION OF CABLE TO T.V. LOOK AT OUR PRICE! **25c**

T.V. ANTENNA SELECTOR (300 ohm)
ENABLES YOU TO SELECT FROM UP TO THREE ANTENNAE AT THE TOUCH OF A SWITCH! **$3.50** p&p 75c

SENSATIONAL NEW BOOK —ELECTRONICS FOR SCHOOLS by R.A. Sparkes



Recommended by Education authorities as an introductory course with the emphasis on practical approach. Over 30 circuits to build– alarms, binary counter, radio etc., How to solder, fault finding, the Resistor code. Notes for teachers PLUS a special order form for all the components you need from DICK! This book could lead to great hobby or rewarding career. Get yours today for only **$4.00** p&p $1.00

NEW Printed Circuit Boards

		$
ETI701	Masthead Amp	1.25
ETI429	LM380	1.25
ETI702	Radar Alarm	1.50
ETI528	Intruder Alarm	1.50
ETI313	Car Alarm	1.20
ETI527	Dimmer	1.20
ETI116	Impedance Meter	1.45
ETI314	Auto Amp	1.00
ETI312	C.O.I.	1.75
ETI430	Line Amp	1.00
ETI426	Rumble Filter	1.20
ETI428	Colour Organ	3.60
ETI533A	Digital Display	1.45
ETI533B	Digital Display	.95
ETI440	Amplifier	3.15
ETI117A	Digital Voltmeter	1.00
ETI117B	Digital Voltmeter	1.00
ETI704	Crosshatch Gen.	1.45
ETI UTILIBOARD		85
75W3	Wiper Control	1.25
75EM6	Optomin	1.25
74 C9	Tape Deck Amp	3.25
75 S04	FM Stereo Decoder	1.35
75 A01	Function Generator	1.50
75 CD7	C.D.I.	1.20

P&P 50c each or 75c for multiple orders!

SAVE over 30% on ROTARY SWITCHES ....

YES! Direct importing by ourselves has again led to huge costs savings.

Switches have ¼" shaft dia. x 1¼" O.A. diam. Make-before-break silver plated spring loaded contacts, standard brass bushing mount.

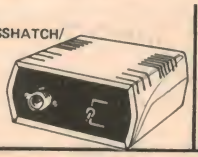
Compare the following prices and see for yourself:

Poles	Positions	Sections	Old Price	New Price	Saving
1	12	1	$2.20	$1.45	34%
2	5	1	$2.20	$1.45	34%
2	6	1	--	$1.45	--
3	4	1	$2.20	$1.45	34%
4	3	1	--	$1.45	--
6	2	1	$3.15	$1.45	64%

(All other switch variations as per our catalogue)

KITS

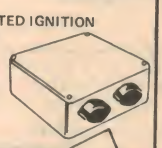
Kit 81 (ET 704) CROSSHATCH/ DOT GENERATOR *(see ET. Aug 75)*



SPECIAL SCREENED FRONT PANEL **$21.50** (P & P 75c)

Kit 82 TRANSISTOR-ASSISTED IGNITION

COMPLETE WITH TRANSISTOR SOCKETS, DIECAST CASE & TRANSISTOR COVERS. See Aug 75 E.A. State wether positive or negetive earth required. **$17.50** (P & P 75c)



NEW C.D.I. KIT (see E.A. July 75)

The only kit with a PRE–PUNCHED HEAVY DUTY ALUMINIUM BOX (saves a lot of hard work!!!).We also give you a prewound secondary to simplify Transformer winding.....Transistor sockets for easy servicing.Build it & fit it in an evening.

fantastic value at **$22.50** p&p $1.00

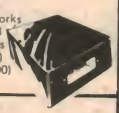
KIT including heavy duty Ducon Capacitor **$26** p&p $2

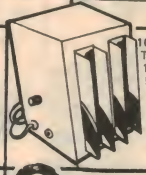
KIT56 High Power Strobe (E.T. Aug 71/25 Top Projects) Ideal for parties, dances etc. to create dazzling effects. Uses large 7" satin finish reflector exactly to original specs. Single tube can easily be converted for 2 tube operation. Don't confuse with cheep, less powerful units. Now only $22.50 (p&p $1.00) Strobe Caps 6.5 uf 250Va.c. **$3.50 each.**

NOTE: All our kits use top quality components, where possible to the specs. given in articles. Occasionally we are forced to substitute alternative components because of availability problems, but these are checked out with magazines concerned.

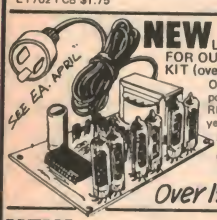
KIT79 ET702 Radar Intruder Alerm

Uses microwaves to detect movement within 10M renge by the Doppler principle. Now you can build a unit that operates on the same principle as the professionals use. Even works through timber and plastic wall panels and screens!! Operates from mains or batteries (extra). Complete kit **$54.00** (p&p $1.00) CL 8960 Radar module **$32.00** (p&p $1.00) ET702 PCB **$1.75**





100W GUITAR AMP (see E.T.I Dec 72) This is THE Guitar Amplifier.A full 100W RMS at 0.5% distortion from 50HZ to 20KHZ with a 4ohm load. Connect as meny speekers as you like as long as the combined impedance is more than 4ohms. Input impedance 3.9K ohm. Extremely rugged construction. **$75.00** p&p $2



NEW LOWER PRICES FOR OUR DIGITAL CLOCK KIT (over 1500 sold)

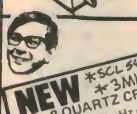
Our huge purchasing power enables us to REDUCE our prices yet again!!!

4 Digit Clock $19.95

6 Digit Clock $24.95

(p & p $1.25)

Over 1500 sold!



NEW *SCL 54/74AT I.C $3.75 + 3MHz Crystal $7.50 = QC–8 QUARTZ CRYSTAL MODULE KIT

Complete with 3mHz crystal & divider IC – gives 50 cycle output to operate virtually any digital clock. Takes only 10 minutes to build – highly accurate. (within seconds a month). Operates on 9 to 15 volts D.C. **$12.50** p&p 50c

Yes with the above module your Dick Smith clock will operate in your car, boat or plane at chronometer standards.

If you are running your clock off 240V A.C. and would like it to continue to operate for up to 48 hours when the power fails, simply use the module with a 9 volt transistor radio battery. It will change over automatically.

Full details in September E.A. or send S.A.E.

NEW *attractive case for our kit clock (above). Plastic case in modern bright cols: Yellow, Green, Red*

8.50

WIDE RANGE OF NEW CMOS

AT PRICES THAT GIVE OUR USUAL FANTASTIC VALUE!

TYPE	DESCRIPTION	PRICE 1 – 9	PRICE 10–up	PRICE 100 mix
SCL4000AE	Dual 3 Input NOR Gate Plus Inverter	.45	.40	.35
SCL4001AE	Quad 3 Input NOR Gate	.45	.40	.35
SCL4002AE	Dual 4 Input NOR Gate	.45	.40	.35
SCL4006AE	18 Stage Shift Register Static	2.75	2.65	2.60
SCL4007AE	Dual Complementary Pair Plus Inverter	.45	.40	.40
SCL4009AE	Hex Buffer/Converter, Inverting	1.25	1.20	1.17
SCL4011AE	Quad 2 Input Nand Gate	.45	.40	.35
SCL4012AE	Dual 4 Input Nand Gate	.45	.40	.35
SCL4013AE	Dual D Type Flip Flop with Reset	1.25	1.15	1.05
SCL4014AE	8 Stage Static Shift Register	2.75	2.65	2.60
SCL4016AE	Quad Bi-Lateral Switch	1.05	1.00	.95
SCL4017AE	Decade Counter/Divider	2.65	2.55	2.50
SCL4018AE	Presettable Divide BY "N" Counter	2.80	2.70	2.65
SCL4021AE	8 Stage Static Shift Register	2.60	2.55	2.50
SCL4022AE	Divide by 8 Counter with 8 Decoder Outputs	2.25	2.20	2.15
SCL4023AE	Triple 3 Input Nand Gate	.45	.40	.35
SCL4025AE	Triple 3 Input NOR Gate	.45	.40	.35
SCL4027AE	Dual J-K Type Flip Flop with Reset	1.25	1.20	1.15
SCL4028AE	BDC to Decimal Decoder	2.10	2.00	1.95
SCL4029AE	Presettable Up/Down 4 Stage Counter	2.85	2.75	2.70
SCL4030AE	Quad Exclusive or Gate	1.00	.95	.90
SCL4049AE	Hex Buffer/Converter, inverting	1.00	.95	.90
SCL4050AE	Hex Buffer/Converter, non inverting	1.00	.95	.90
SCL4071AE	Quad 2 Input or Gate	.45	.40	.35
SCL4081AE	Quad 2 Input and Gate	.45	.40	.35
SCL4416AE	Double Pole Double Throw Switch	1.00	.95	.90
SCL4426AE	Decade Counter/7 Segment Decoder/Driver	3.40	3.30	3.25
SCL4449AE	Economy Hex Inverter	.45	.40	.35
SCL4511AE	BCD to 7 Segment Latch/Decoder/Driver	2.65	2.55	2.50
SCL4518AE	Dual BCD Up Counter	2.50	2.40	2.35
SCL4520AE	Duel 4 Stage Binary Up Counter	2.80	2.70	2.65
SCL4528AE	Dual Retriggerable Monostable Multivibrator	1.75	1.70	1.65
SCL5411AE	Oscillator 16 Stage Divider with Buffer	3.75	3.65	3.60
MC14553	Latch BCD to 7 Segment Decoder and Driver	10.50	10.30	10.20
CA3130	Fet Input Operational Amplifier	1.85	1.80	1.75
MM5314	DIL Clock I.C.	5.90	5.80	$4.20

all these CMOS are packed by us in a special conducting foam to prevent damage by electrostatic charges

200 MHz COUNTER KIT (see E.A. December 73)

Basic 20MHz Counter hes 4½ digit L.E.D. readout with leading zero suppression. Crystal timebase for self calibration or ext. cal. IM/50pf input impedance and 50mV to 10V rms sensitivity. There can't be a better, cheaper instrument anywhere. **$98.00**

200MHz Presceler extends the capability of the basic 20MHz by a factor of ten. Well worth buying the complete kit for just **$120.00**

P&P $1.00

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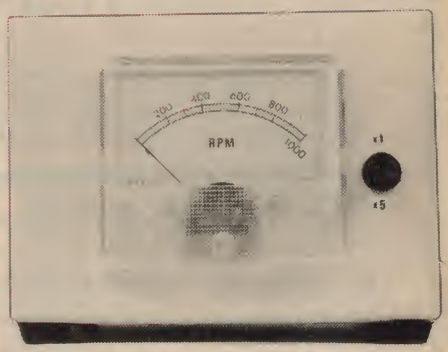
For Saturday-afternoon mechanics here is a

Tacho for Tune-Ups

by LEO SIMPSON

There must be many Saturday-afternoon mechanics who wish they had access to a tachometer to enable them to correctly adjust the carburettor and ignition system. Here then is a tachometer for just this purpose. It is suitable for both CDI and conventional ignition systems.



Years ago, it was considered an easy task to set the idling speed and mixture of the average motor car. You just set the idling speed so that the motor ran reasonably smoothly without "missing a beat", and then adjusted the mixture so that the motor ran smoothly with no tendency to cut out when the accelerator was suddenly closed and gave good response when the accelerator was suddenly opened. Perhaps you then re-adjusted the idling speed screw to revert to the desired idling speed and that was that. More or less. It did not really matter. Petrol was less expensive and engines were less critical.

No longer is the task simple. And on cars made in 1964 or after, the idling mixture screw is sealed to prevent adjustment by the home mechanic. Only the idling speed can be adjusted and for this task a tachometer of known accuracy is essential. This is particularly the case for cars with automatic transmission.

For example, the idling speed of a typical 6-cylinder car with automatic transmission is in the region of 500 rpm. If the setting is too high, the car tends to leap forward as soon as your foot is removed from the brake and if it is too low the engine will run roughly, have a tendency to stall and have higher than usual bearing wear.

Ignition timing adjustments also require the use of a tachometer. For example, the initial ignition timing advance on a Holden HQ 6-cylinder model is 5 degrees BTDC (before top dead centre) at 480 to 520 rpm. This engine speed is obtained with the transmission in Drive (with the handbrake hard on) and the vacuum line to the distributor diaphram disconnected and plugged.

Operation of the centrifugal advance mechanism should be checked by running the engine up to about 2000 rpm (in neutral).

So a simple bench tachometer is a very useful aid to the home mechanic. Accordingly, we have produced the simple instrument presented here. It has two ranges: 0 to 1000 rpm and 0 to 5000 rpm. The low range is suitable for idling speed adjustments on most cars while the higher range will enable tests at higher speeds.

The higher range is optional. Although marked 0-5000 rpm, this by no means implies that you should run any engine up to 5000 rpm while in neutral. In fact this is likely to put a piston through the head. And that is a repair job outside the scope of the home mechanic.

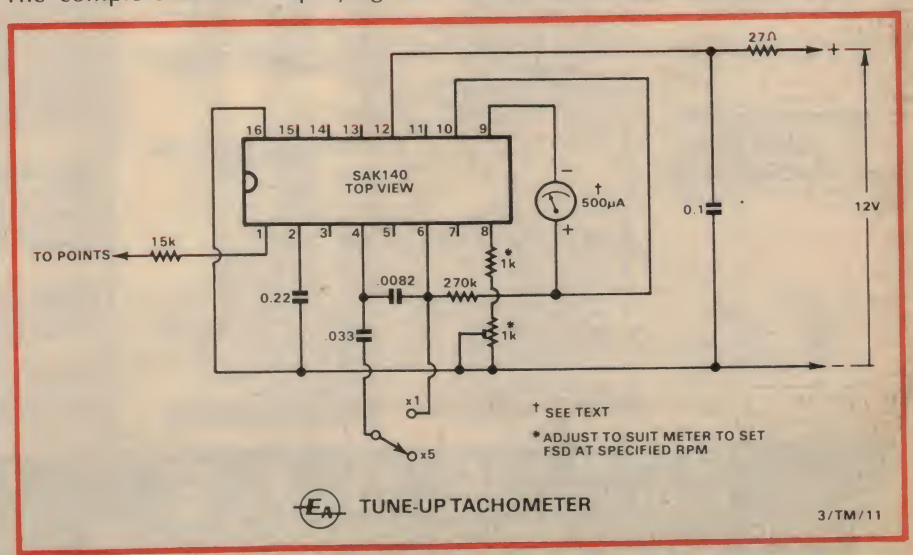
Note: Engines run to high rpm in neutral (or in gear on a trailing throttle) can throw a piston due to the relative lack of gas pressure in the cylinder during compression and combustion. Under normal loads, the gas pressure balances the high inertial forces applied by the piston at the top of the stroke.

At the heart of the tachometer circuit is an economy 16-pin dual in-line integrated circuit mentioned in our "What's new in Solid State" page in April of this year. It is the SAK140, supplied by Philips Elcoma.

The SAK140 is basically a monostable multivibrator which converts pulses from the contact breaker points into output current pulses of fixed duration and amplitude, to drive a meter movement. The complete circuit employing the SAK140 comprises only four resistors, three capacitors and one preset potentiometer.

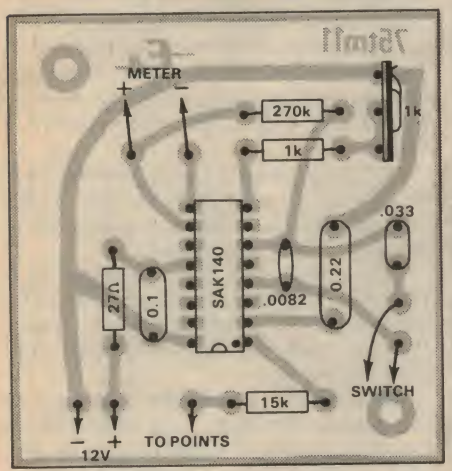
Not a great deal can be gleaned about the operation of the SAK140 from its internal circuitry so we have not included the diagram with this article. The IC is protected against reverse supply connection and will operate at voltages from 10 to 18V with little variation in accuracy.

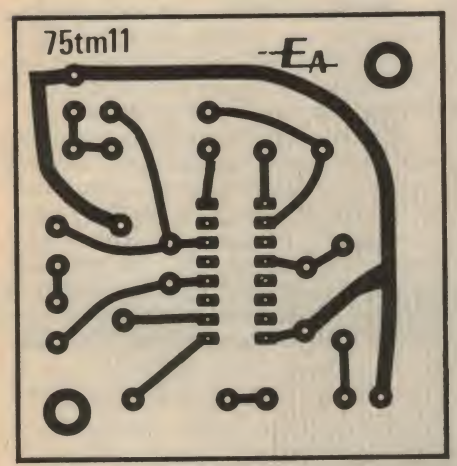
Input signals to pin 1 are clipped by an internal zener diode and high frequency components are attenuated by the 0.22uF by pass capacitor connected to pin 2. Duration of the pulses fed to the meter is determined by the 270k resistor connected between pins 10 and 6 and the capacitor connected between pins 4 and 6. The values of these components are selected to give the longest possible pulse length consistent with the maximum pulse repetition rate. If the pulse rate is too high or the pulse duration too long, the IC "blocks" and



no output is delivered to the meter. When the tacho is switched to the 5000 rpm range, the .0082uF capacitor is in circuit. When the 1000 rpm range is used, the .033uF capacitor is switched in parallel with the .0082uF to multiply the capacitance by very close to 5 times.

Strictly speaking, the .0082uF and .033uF capacitors should be very close tolerance units so that the error in switching from one range to another is as small as possible. In practice, it does not really matter since accuracy on the 5000 rpm range is not at all critical. High accuracy is required on the 1000 rpm range so calibration is performed on that range.





Virtually any meter movement can be used with the SAK140 provided it has a FSD sensitivity of 10mA or less. The circuit is adjusted to suit the meter sensitivity by selecting the components associated with pin 8. Our circuit suits a meter with a FSD sensitivity of 500uA but meters of 1mA sensitivity can also be used without any circuit change. If meters with lower sensitivity are used the preset pot and 1k resistor should be reduced in value. Minimum resistance from pin 8 to negative should not be less than 100 ohms.

Note that constructors will have to label the meter movement with suitable calibrations and "RPM" title using Letraset rub-on lettering. Unsuitable calibrations can easily be removed with a typewriter eraser.

One of the advantages of this tacho circuit is that it will function with conventional or capacitor discharge ignition systems without any modification being necessary. In both cases, the input pulses to pin 1 are taken from across the distributor points.

Note that besides being able to operate from any of the points-triggered 12V CDI systems featured in "Electronics Australia" it is also compatible with the transistor assisted ignition system featured in the August, 1975 issue. In the case of this circuit, the trigger pulses may be taken from the collector of Tr2 or from the lead to the points.

The Tacho is normally powered from the vehicle battery but where it is to be used with 6V vehicles it will have to be provided with its own 12V supply. In the former case, three clip leads will be required to make connection to the vehicle battery and to the points side of the ignition coil. In the latter case, two clip leads will be required, one connecting to the points as before and one to the negative post of the vehicle battery.

We assembled the prototype into a small chassis which we had on hand but we imagine that for a project of this simplicity a cabinet or chassis made from a few scraps of timber would suffice. If the chassis is made of metal it should be connected to the battery supply line which is normally connected to the vehicle chassis.

This latter measure prevents hash picked up by the metal chassis of the tacho from causing erratic and erroneous readings.

A small PC board measuring 57 x 60mm accommodates the circuit components. Assembly is straightforward. We used a socket for the integrated circuit but this is optional. Resistors may be ¼ or ½W rating, except for the 15k input resistor which should be a ½W type to provide a rating of 250V.

Any general-purpose SPST toggle switch may be used for the range switch. The type we used was one of the McMurdo 475 series.

TACHO PARTS LIST

1 chassis (see text)
1 PC board, 57 x 60mm, code 75tm11
1 SAK140 integrated circuit
1 500uA FSD meter movement
1 .0082uF metallised polyester capacitor
1 .033uF metallised polyester capacitor
1 0.1uF metallised polyester or low voltage ceramic capacitor
1 0.22uF metallised polyester or low voltage ceramic capacitor
(½ or ¼W resistors)
1 x 27 ohms, 1 x 1k, 1 x 15k/½W
1 x 270k
1 x 1k preset potentiometer

Capacitors used were metallised polyester types but the 0.1uF and 0.22uF bypass capacitors could be low-voltage ceramic types. Component tolerances are not of any particular importance except for the .0082 and .033uF capacitors, as noted above. Unless you particularly desire high accuracy on the 5000 rpm range, 10 percent tolerance capacitors will suffice. Calibrate the tacho on the 1000 rpm range which is where accuracy is required for idle speed adjustments.

Calibration presents the biggest problem in this constructional project. Perhaps the easiest way is to calibrate it in comparison with a tachometer of known accuracy. This would rule out many of the cheaper automotive tachometers with 270 degree meter movements since their accuracy would be doubtful below 1000 rpm.

A more accurate and repeatable method of calibration is to connect the tacho to a vehicle and then use a fluores-

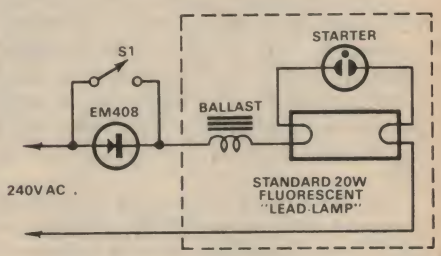


Fig. 2 above is the circuit of a "strobe" for calibration. Below is a photograph of the PC board installed in the chassis.

cent light to act as a strobe light at 50Hz. A standard garage fluorescent "lead-lamp" would be ideal for the purpose and the inclusion of a diode as shown in the circuit of Fig. 2 enables it to deliver 50Hz light pulses instead of 100Hz under normal conditions.

When the modified lead lamp is first turned on the diode should be out of circuit until the lamp lights fully. Then the diode is switched in to provide 50Hz operation. Note: we do not recommend

(Continued on page 106)

Mains supply for car cassette players

If you have a cassette or cartridge tape player installed in your car and it is fitted in a cradle for easy removal, then you have no doubt been wanting to use it elsewhere, powered from the normal 240V mains supply. Using this simple supply you can do so, even if your player uses a power consuming solenoid operated mechanism.

by DAVID EDWARDS

Our new power supply has a nominal 12V rating, and can supply a 2A current continually. Up to 5A can be supplied intermittently. The regulation is only modest, but is quite adequate as tape players are designed to operate from a supply which varies from about 11V to 15V.

Our estimate for the total cost of all components is about $20.00, which compares very favourably with the price of similar commercial units. It is built in a small steel box which acts as a heatsink for the series pass transistor, and also provides some shielding from the magnetic field of the transformer.

As shown in the diagram, we have opted for a very simple circuit. The transformer is one of the new low height 60VA Ferguson range, and has two 15V secondaries, each with a tap at 12V, and rated at 2A each. We have connected them in series and used two diodes to form a fullwave rectifier, using the centre tap. We have opted for this configuration rather than a standard bridge, as it gives only one diode in series with the load, instead of two.

The diodes specified are type 1N5408. These are rated at 1,000V at 3A. We have used these because of their price advantage, as they are available from Dick Smith Wholesale Pty Ltd for only 40c each. However, any silicon diodes with a current rating of 3A or more and a PIV rating of more than 45V would be suitable.

Base current for the 2N3055 series pass transistor is supplied via the 68 ohm 5W resistor. The voltage at the base is regulated by the zener diode, for all values of load current up to 2A. At values of load current above this, the regulation falls off fairly rapidly. Maximum power dissipated in the 2N3055 is of the order of 24W, so fairly good heatsinking is required. Maximum dissipation occurs at full load and when the supply voltage is at a maximum.

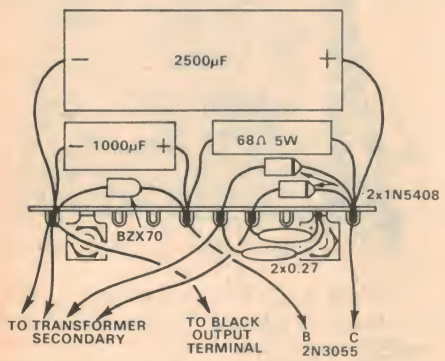
In the interests of simplicity and economy, we have not provided any protection facilities. Sufficient protection for the player unit should be provided by the in-line fuse with which these are usually fitted. If your unit does not have such a fuse, then it would be wise to fit one.

RFI suppression of hash entering from the mains is provided by the 0.47uF ceramic capacitors bypassing the ends of the transformer secondary.

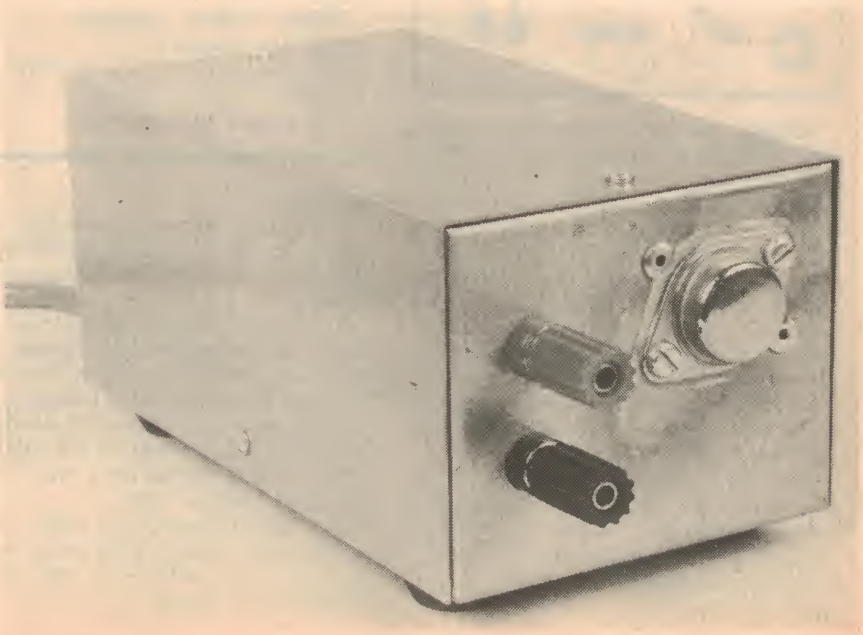
The component shown dotted is a 1000uF electrolytic capacitor. If this is fitted across the zener diode as shown, then the ripple performance of the supply is improved.

Alternatively, it may be fitted across the output terminals. This will improve the short term load regulation of the supply, so that it can withstand short overloads better. This type of overload will occur when some player solenoids operate. However unless your player has an exceptionally heavy current drain, this component should not be necessary.

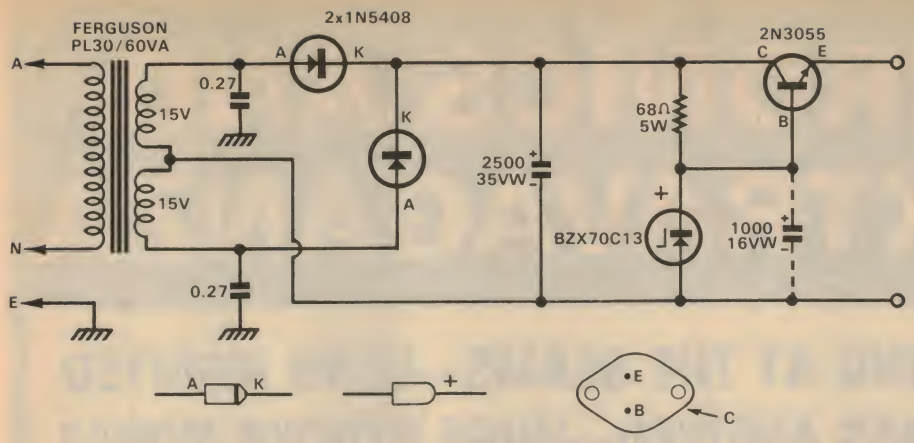
With the 1000uF capacitor fitted across the zener diode, we measured the load regulation as 4% for currents up to 1A and 6% for currents up to 2A. The line regulation was 1%, for variations in the supply voltage of + and -10%. The peak-to-peak ripple at the output was 0.02% at no load, 0.16% at 1A, and 0.32% at 2A. These figures appear more than ade-



The diagram above is to guide you in wiring the 10-lug tagstrip used to support the basic rectifier components and those associated with the zener diode. Note the polarity of all three diodes, and of the electrolytics.



Fitted into a low cost utility box, the new supply is compact and easy to build. It will deliver up to 2 amps continuously, with peaks of up to 5 amps for solenoid operation.



PLAYER POWER SUPPLY

The circuit for the new supply, which is basically a conventional full-wave rectifier followed by a simple series-pass regulator.

quate for most players, and those we have tried with the supply performed in a completely satisfactory manner.

We fitted our supply into a standard box. The type we used is designated AMB15, and is made by Wardrope and Carroll Fabrications Pty Ltd. This is a steel box, measuring 153 x 86 x 71 mm, and has a grey hammertone finish. As output terminals, we fitted a pair of combination banana plug and screw terminals, one red and one black. If required, a suitable polarised plug and socket could be fitted instead.

The power transistor is mounted on one end of the case, using a plastic mounting socket. It is electrically insulated from the case by a mica washer, but thermally connected using a silicon grease. All other components are mounted on a small section of tag-strip.

Construction of the supply should not present any difficulties. The mains cord enters through a grommeted hole, and is then clamped to the case. The active and neutral leads terminate at the terminal block, while the earth lead is wrapped and soldered to a lug which is then connected to the case. The most convenient spot is at the cord clamp.

Mount all the small components onto the tag-strip, as well as the required connecting wires, using the diagram as a guide. Ensure that when the tag-strip is fitted into the case, there are no short circuits, particularly to the case. Then fit and mount the socket for the power transistor, as well as the two output terminals.

Pop rivets make an easy and convenient way of fastening the various components to the case. As there is not a great deal of room to spare, it is wise to check first that all components will fit in their correct places, before actually riveting any in place. The way in which we positioned our components can be seen from the photographs.

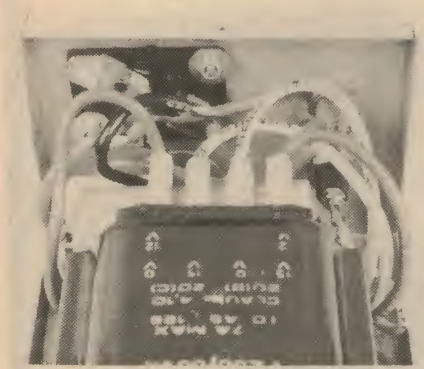
The transformer is mounted centrally in the box, leaving sufficient room for the push-on connectors supplied with it. When all components have been fitted, the lid may be attached using self tapping screws. This completes the Player Power Supply, which can now be tested by actually using it.

When in use, remember that the case may become quite warm, particularly when currents approaching 2A are being drawn. So do not place the unit near any heat sensitive objects.

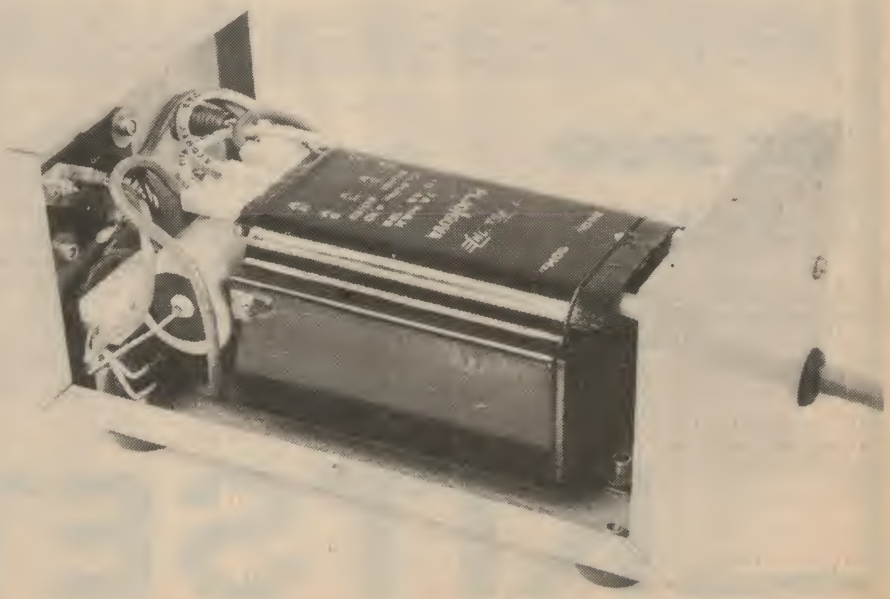
LIST OF PARTS

1 steel case, 153 x 86 x 71 mm, AMB15 or similar.
1 mains transformer, 30V @ 2A, centre tapped (Ferguson PL30/60VA or similar).
1 2N3055 power transistor, with mounting kit to suit.
1 BZX70/C13 Zener diode (13V at 2.5W).
2 1N5408 silicon diodes (3A rating).
1 2500uF 35VW electrolytic capacitor, pigtail type.
1 1000uF 16VW electrolytic capacitor, pigtail type (optional).
2 0.27uF ceramic capacitors, 25VW.
1 68 ohm 5W resistor.
1 mains plug, mains cord, grommet and mains cord clamp.
1 2-way terminal block.
4 rubber feet.
2 screw terminals, one red, one black.
1 10-lug tag strip, with 2 mounting lugs.
Pop rivets, washers, hook-up wire, solder, machine screws and nuts, self tapping screws.

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with high ratings may generally be used provided they are physically compatible.



Above is a close-up of the wiring inside the case of the supply at the transistor and output terminals end. Note that the prototype unit uses a TO-3 transistor socket, pop rivetted in place.



At right is a general view of the inside of the supply case, showing how few parts are used apart from the 60VA transformer.

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LF quartz crystals in TO-5 case

By using a tuning fork construction, low frequency quartz crystals have been reduced considerably in size. Those available from the Statek Corporation are in a TO-5 transistor case, making them very suitable for electronic watches and similar subminiature equipment. They can be used in a simple oscillator circuit, employing a low-cost CMOS device.

by IAN POGSON

Not many years ago, the quartz crystal clock made its appearance—rather a clumsy device on present standards—but it was a big step forward in timekeeping. Since then, the crystal clock has become increasingly refined, accuracy has been improved and size has shrunk dramatically.

As the size was reduced, so the size of suitable crystals was also reduced and this leads naturally to the concept of a crystal controlled watch mechanism. With the size of a wrist watch more or less defined, it became imperative to produce a crystal of quite minute proportions, compared with those of yesteryear. Furthermore, to keep complexity and battery drain to a minimum, the number of binary dividers should be kept to a minimum. This meant that the crystal frequency should be kept as low as possible. Unfortunately, low frequency crystals are normally quite large. This was the challenge and it has been very successfully solved by a number of manufacturers.

A good example of this is a range of crystals made by the Statek Corporation of California and imported here by Ampec Engineering Co. The frequency range quoted is from 10kHz to 100kHz in the fundamental mode and 100kHz to 300kHz in the overtone mode. However, only certain specific frequencies are normally available ex stock and more about that a little later on.

Statek has solved the problem of size by making the crystal in a tuning fork configuration. This enables the size to be reduced by about four times, compared with more conventional low frequency crystals. To convey some idea as to how small these crystals are, they have been mounted in a standard TO-5 case. For readers not familiar with this transistor package it is 8.5 mm in diameter and 6.6mm high, with the usual three leads.

The diagram shows the general construction of the tuning fork crystal, with deposited electrodes and external connections. A voltage applied between the top electrode on the inside of the tines (pin 2) and the bottom electrode (pin 3) will create a field in the quartz, causing a lengthwise extension or contraction of the tine, according to the piezoelectric effect. An extension of the inside electrode area will flex the tines outward. At the same time, the outside electrode area is compressed, thus generating a field of opposite polarity in this region and charging the outside electrode (pin 1).

Applying an opposite voltage reverses the effect, flexing the tines inward. If the driving voltage is oscillating near the mechanical resonant frequency of the crystal the amplitude of vibration will increase and provide a voltage output.

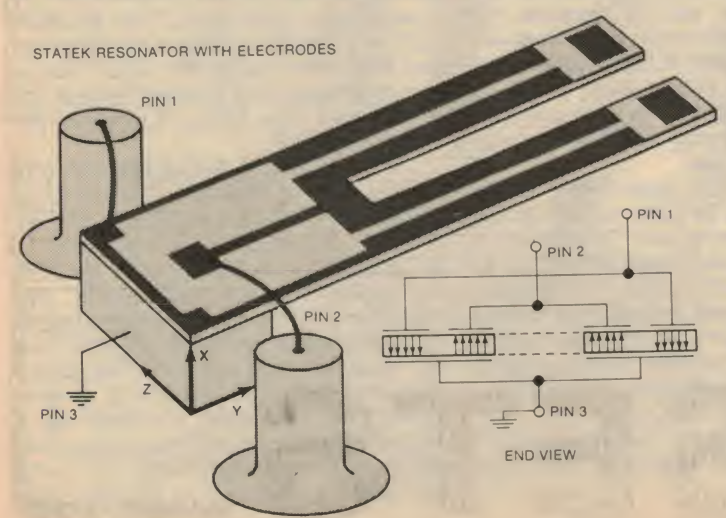
The resonant frequency of the crystal is mainly determined by its geometry. Preliminary adjustment of the crystal frequency is made by depositing gold on the ends of the tines. The gold is then trimmed off with a laser, tuning the crystal to the specified frequency.

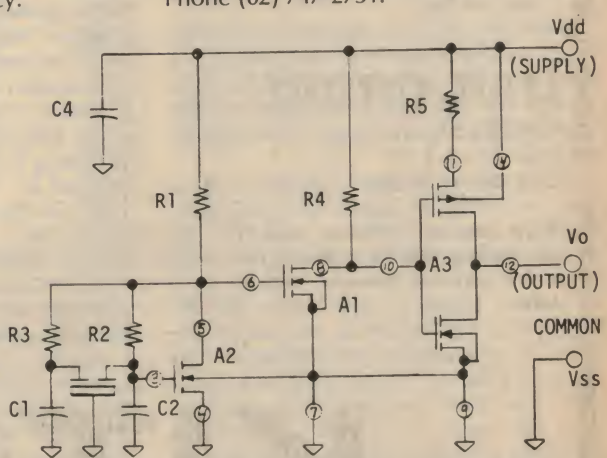
Two types of crystal are available, Model SX-1H for series resonance oscillator circuits and Model SX-1V for parallel operation. Stock frequencies cover a wide range and this is what is currently being offered (all frequencies in kHz):
10, 12.8, 15.36, 16, 16.384, 18.641, 19.2, 20.48, 24.576, 28.16, 30.72, 31.5, 32.768, 36.864, 38.4, 40.96, 60, 76.8, 100, 240.

Some of the possible uses for a few of the frequencies available may be of interest.
10.000kHz decimal time base
15.360 kHz 60Hz time base
16.384kHz seconds timer
19.200kHz modem clock
32.768kHz seconds timer
100.000kHz decimal time.base
240.000kHz motor speed control

All frequencies are available in either series or parallel mode. Suggested circuits are available for both modes of operation, but due to space restrictions we are only giving the circuit for parallel operation here. The active device is a CMOS IC, type 4007A and the circled numbers are those corresponding to the pin numbers of the 4007A. Supply voltage may be between 5 and 15V. Circuit component values vary according to the crystal frequency used.

Full details of these crystals, including application notes, prices and availability are available from Ampec Engineering Co, P.O. Box 18, Strathfield, NSW 2135. Phone (02) 747-2731.





The diagram at left shows the basic construction of a tuning fork crystal, with a CMOS oscillator circuit shown above.

Commercial front ends for PM146 FM-AM tuner

For those who feel a little nervous about tackling the VHF front-end section of our new FM/AM stereo tuner, we have looked into the possibility of substituting one of a number of commercial front-end modules. This article discusses what you would need to do in order to use one of these modules.

by IAN POGSON

As part of the new FM/AM stereo tuner design described in the July, August and September issues, we gave details of an FM front end unit. This was specially designed for home construction, with straightforward construction and a circuit which combines high performance with stability. However because those without much experience of VHF circuitry might be daunted at the prospect of getting such a front end going, we suggested that an alternative would be to substitute a commercial front end module.

In order to provide some assistance to those who want to take this alternative course, we have looked at some of the commercial front ends which are currently available, and checked them for suitability. In this article we are presenting our findings.

Broadly speaking, all of the commercial units will cost you more than our own build-it-yourself front end, to an extent which varies according to the features offered. But most are quite reasonably priced, considering they are complete and ready to go.

Perhaps the best approach would be to take each of the front ends which we have checked and discuss the features, merits, etc. We can then leave it to the individual reader to decide which one he will use.

All of the front ends which we have seen are made in Japan; the first one to come to our attention is imported by Philips Elcoma. With a balanced aerial input, there is one tuned circuit at signal frequency ahead of a junction FET RF stage. This is followed by two tuned circuits in a bandpass arrangement. The mixer is a conventional bipolar transistor with injection from the local oscillator into the base of the mixer. The local oscillator also uses a bipolar transistor, in a Colpitts circuit. IF output at 10.7MHz is via a transformer, the output impedance of which is quoted as 300 ohms.

AGC may be applied to the gate of the JFET RF amplifier and this requires a negative AGC voltage. There appears to be no provision for the application of AFC to the local oscillator.

In addition to the four gang sections for the FM front end, incorporated into the same assembly are two gang sections to be used for an AM tuner. These sections are identical and the capacitance range is quoted as 10pF minimum to 426.4pF maximum.

In terms of compatability with our IF strip and decoder, there is no problem with power supply for this unit as 12V is required and available. If you intend to use a balanced aerial feedline then it may be connected directly. On the other hand, an unbalanced line will require a balun transformer. The 300 ohm output impedance matches properly into the IF amplifier.

As already mentioned, there appears to be no provision for AFC. Looking at the oscillator stability figures provided, they appear to be very good and we imagine that the makers decided that AFC was not really necessary. No doubt AFC could be fitted to the oscillator, but it would mean getting right inside to effect this change. As such, it would be defeating the idea of making the front end job an easy one.

As for the AGC, again there is not much which can be done readily, as the AGC provided from our IF IC is positive, suited more to dual gate MOSFETs. As with the AFC no doubt this problem could be overcome, probably by adding a negative output to the power supply, together with some extra circuitry. Again, this would be defeating our purpose. Happily, however, we doubt the absolute necessity for AGC, except possibly in a location of very strong signal strength.

As there are only two gang sections for an AM tuner, and the capacitance is 426pF per section, there is obviously a compatibility problem with our AM tuner section. This is because we used a 3-gang capacitor with 240pF per section.

As it happens there is a fairly simple solution, which is to omit the second section which normally tunes the circuit between the RF amplifier and the mixer. The coil is fitted, together with other items associated with it, but it is not tuned. This results in a noticeable, but not at all serious drop in sensitivity, together with some degrading of front end selectivity. Generally, this is not very important.

As the capacitance is much more than the coils were designed for, we found that you can overcome this by adding a padder capacitor of 560pF in series with the first section and the aerial coil. And instead of the 200pF padder in the oscillator circuit, substitute 150pF.

Before leaving this particular front end, we understand from Elcoma that they also list a companion front end, similar to the former, but with three AM gang sections, all identical and with a capacitance of 426pF per section. This one would naturally suit our purpose very well, in that the middle AM section could be used to tune the output circuit of the RF amplifier. It would be necessary to fit a 560pF padder in this position, as for the aerial coil.

The other two front ends are imported by Audiosound and distributed by Watkin Wynne Pty Ltd, 32 Falcon Street, Crows Nest, NSW 2065. One of these units is in about the same class as the one just described, while the other one is more elaborate and tending towards the professional area. We will consider the simpler one first.

The aerial input is balanced and centre tapped, followed by a tuned circuit at signal frequency into a dual gate FET RF amplifier. Provision is made for AGC to be applied to the first gate of the FET. This would require a negative AGC voltage. There is one tuned circuit at signal frequency between the RF amplifier and the mixer, a bipolar transistor. The output from the mixer at 10.7MHz is via a transformer, the secondary of which has a capacitive divider across it to give an output impedance of 300 ohms. The local oscillator is a Colpitts, with a bipolar tran-

sistor and provision for AFC. This requires a negative applied voltage.

As the aerial input is balanced, a 300 ohm feedline could be used directly. Also, as the input coil is centre tapped, we imagine that a 75 ohm coax feedline could be applied directly, between one side and earth. Alternatively, a balun could be used in the ordinary way.

In common with the unit described earlier, this one as tested required a negative voltage AGC and the same conditions and comments apply here. Although AFC is in this case provided for, as supplied by the makers it needs a negative standing voltage. However we have been assured by the importers that the diode will be reversed in future, so that the positive voltage provided by our IF strip may be used with this front end as you will buy it.

The required power supply is again 12V and so is readily available. Also, the IF output impedance of 300 ohms gives a correct match into the 10.7MHz ceramic filter.

The tuning gang includes three sections for use on an AM tuner and in this respect it meets our requirements—particularly as one section is a padderless oscillator section.

We used a maximum capacitance of 240pF per section, which made it easy for us to cover the broadcast band quite comfortably. The normally available Roblan 3-gang padderless AM gang has a maximum capacitance of 200pF on the two RF sections and 90pF on the oscillator section and with these values, it also covers the band but with little to spare.

The gang of the front end under discussion has two sections quoted as 190.6pF each, with 76.5pF for the oscillator section. At first sight it would appear that these values would not be sufficient to cover the band properly, however it has a lower minimum capacitance than the Roblan, and this could allow it to cover the band despite the lower capacitance. It means that the slugs in the coils would need to be screwed in a little further, though.

Finally, we come to the more elaborate unit. Before proceeding, it may be well to point out that this unit is FM only; it has no AM sections on the tuning gang. The aerial input is for 75 ohms unbalanced, followed by a tuned circuit at signal frequency into a dual gate FET RF amplifier. Between the output of the RF amplifier and the input of the dual gate FET mixer are three tuned circuits coupled in cascade. This amounts to four tuned circuits at signal frequency, resulting in excellent front end rejection of IF breakthrough and image frequencies.

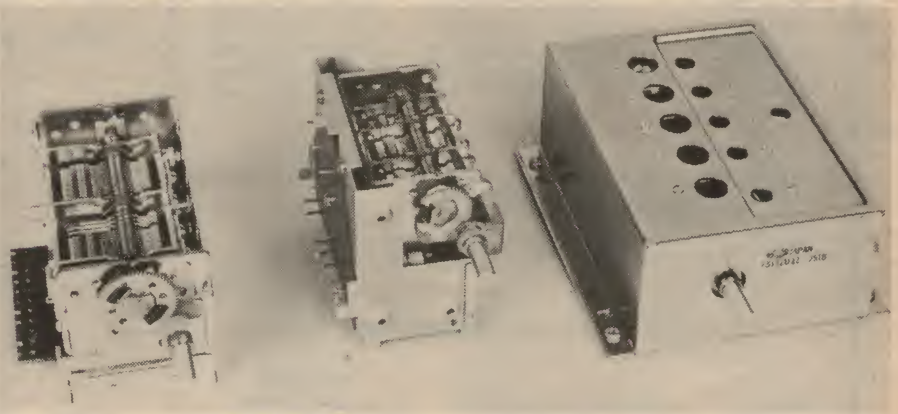
IF output at 10.7MHz is via a double tuned transformer, adjusted to give an output impedance of 500 ohms. We suggest that this could be shunted with an 820 ohm resistor to give 300 ohms and so match into the 10.7MHz ceramic filter.

There appears to be no provision for AGC to the RF amplifier, which lends strength to the thought that AGC is not really necessary in most conditions.

The local oscillator is a Colpitts with a bipolar transistor. Provision is made for AFC but again, the diode is orientated such that a negative standing voltage would be required. Again, the importers are prepared to reverse the diode so that a positive voltage may be used for AFC.

In common with all the other units, this one requires a supply of 12 volts. A 75 ohm unbalanced feedline may be connected directly but a balun would be needed for a balanced 300 ohm line. This unit has been designed with high performance in mind, particularly with freedom from spurious responses and should meet the needs of the more fastidious and for professional applications.

I have been able to check samples of three of the four front ends which we have discussed. The exception is the one listed by Elcoma with a three section gang for AM.



The three commercial FM front ends discussed in this article. The unit imported by Philips Elcoma is at left, while the two units imported by Audiosound are at centre and right. The latter two units have provision for AFC.

The original front end was disconnected from the FM IF system and each one of the commercial front ends was connected in turn and tried under somewhat less than ideal conditions. The tests were done in our laboratory, with an indoor vertical folded dipole aerial. In addition to the one official FM station operating in Sydney, the other signals which are available are the sound of channels 3, 4 and 5, on 91.75MHz, 100.75MHz and 107.75MHz respectively, in addition to the vision carriers of channels 4 and 5.

All units performed well under a listening test across the full band. In addition to 2MBS-FM, we were able to tune in the sound of the three TV channels previously mentioned. Channels 3 and 5 are about 80 miles away, with channel 4 about half that distance. It was also interesting to note that the vision carriers were very much in evidence, but when tuned in properly the AM rejection was so good that the characteristic buzz was scarcely audible. This feature is attributable to the rejection of the IF system, rather than the front end.

In all cases, the sensitivity was higher than with our own front end but we have already commented on this and the reasons for it. Without making actual instrument measurements it is difficult to draw fine lines between the performance of each of the front ends, but the more elaborate unit did seem to have a slight edge on the rest.

From a physical point of view, the smaller ones offered by Elcoma and Audiosound should fit in the space occupied by our own front end. The large Elcoma unit would require somewhat more depth and the FM only unit of Audiosound is rather larger again and would not fit the space available.

The gang spindle drive has a 3:1 step up and because of this and the inevitable differences in tuning law, the dial scale provided on our new front panel would not be suitable. If the Jaycar drum type Z10 were used instead of type Z6 as used on the original, a scale 140mm long would be needed instead of the 90 mm long scale as at present. There is room in the window of the front panel to accommodate this.

To summarise, the two smaller front-ends could be fitted to our tuner without too much trouble, although the problem of the dial scale remains. At this stage we have no definite plans to give details of the required modifications, including a new dial scale, but if a demand is evident in the future this will be considered.

Where readers may be considering either of the two larger units, then the physical layout would have to be changed and this must be left to the resources of the individual.

By the time this appears in print, we hope that there will have been more developments towards the introduction of more FM services throughout the country. Perhaps we may have to be patient for a little longer but I am sure that it will be worth the waiting when it does eventuate.

FERGUSON

SPECIFICATION—GENERAL PURPOSE TRANSFORMERS

LOW HEIGHT CONSTRUCTION

PRINTED CIRCUIT BOARD MOUNTING 5VA

TYPE No.	SERIES CONNECTIONS	PARALLEL CONNECTIONS
PL6/5VA	6 volts at 0.83 amp	3 volts at 1.67 amp
PL9/5VA	9 volts at 0.56 amp	4.5 volts at 1.11 amp
PL12/5VA	12 volts at 0.42 amp	6 volts at 0.83 amp
PL15/5VA	15 volts at 0.33 amp	7.5 volts at 0.67 amp
PL18/5VA	18 volts at 0.28 amp	9 volts at 0.56 amp
PL24/5VA	24 volts at 0.21 amp	12 volts at 0.42 amp
PL30/5VA	30 volts at 0.17 amp	15 volts at 0.33 amp

CHASSIS OR FRAME MOUNTING 20VA

TYPE No.	SERIES CONNECTIONS	PARALLEL CONNECTIONS
PL12/20VA	12 volts at 1.67 amps	6 volts at 3.33 amps
PL15/20VA	15 volts at 1.33 amps	7.5 volts at 2.67 amps
PL18/20VA	18 volts at 1.11 amps	9 volts at 2.22 amps
PL24/20VA	24 volts at 0.83 amps	12 volts at 1.67 amps
PL30/20VA	30 volts at 0.67 amps	15 volts at 1.33 amps
PL40/20VA	40 volts at 0.50 amps	20 volts at 1.00 amps
PL50/20VA	50 volts at 0.40 amps	25 volts at 0.80 amps

PL1.5-18/20VA
Is provided with a multi tapped single secondary winding rated at 1.11 amps from which the following voltages are obtainable:
1.5V, 3V, 4.5V, 6V, 7.5V, 9V, 10.5V, 12V, 13.5V, 15V, and 18V.
Additionally centre tap configurations are all obtainable e.g.:
9V-0-9V, 7.5V-0-7.5V, 6V-0-6V, 4.5V-0-4.5V, 3V-0-3V, and 1.5V-0-1.5V.

CHASSIS OR FRAME MOUNTING 40VA

TYPE No.	SERIES CONNECTIONS	PARALLEL CONNECTIONS
PL15/40VA	15v, 13.5v, 12v, 9v 3v at 2.67A	7.5v, 6v, 1.5v at 5.33A
PL30/40VA	30v, 27v, 24v, 18v, 6v at 1.33A	15v, 12v, 3v at 2.67A
PL50/40VA	50v, 45v, 40v, 30v, 10v at 0.8A	25v, 20v, 5v at 1.6A
PL30-9/40VA	30v at 0.5A with 9v at 3.0A	15v at 1.0A with 9v at 3.0A

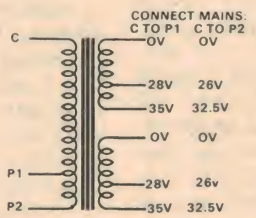
PL1.5-18/40VA
Is provided with a multi tapped single secondary winding rated at 2.22 amps from which the following voltages are obtainable:
1.5V, 3V, 4.5V, 6V, 7.5V, 9V, 10.5V, 12V, 13.5v, 15V, and 18V.
Additionally centre tap configurations are all obtainable e.g.:
9V-0-9V, 7.5V-0-7.5V, 6V-0-6V, 4.5V-0-4.5V, 3V-0-3V, and 1.5V-0-1.5v.

CHASSIS OR FRAME MOUNTING 60VA

TYPE No.	SERIES CONNECTIONS	PARALLEL CONNECTIONS
PL30/60VA	30v,27v,24v,18v 6v at 2.0A	15v,12v,3v,at 4.0A
PL50/60VA	50v,45v,40v,30v, 10v at 1.2A	25v, 20v,5v at 2.4A
PL80/60VA	80v,70v,60v,50v 20v, at 0.75A	40v,30v,10v at 1.5A

CONVENTIONAL CONSTRUCTION

TYPE No.	TOTAL V.A.	SERIES CONNECTIONS	PARALLEL CONNECTIONS
PF265	70	17v, 11.5v, 10v 8.5v at 4.2A	
PF1728	14	12.6v at 1.1A	6.3v at 2.2A
PF2235*	12	150v, 125v, 100v, 75v, 50v, 25v at 0.03A with 6.3v at 1.2A	
PF2315	6.5	6.3v at 1.0A	
PF2440	60	38v at 1.5A	19v at 3.0A
PF2565	12.5	25v at 0.5A	12.6V at 1.0A
PF2851	2.5	12v at 0.2A	6v at 0.4A
PF2876	65	64v at 1.0A	32v at 2.0A
		OR	OR
		60v at 1.0A Fitted with E.S. Shield	30v at 2.0A
PF3259	100	50v at 2.0A Fitted with E.S. Shield	25v at 4.0A
PF3559	30	30v at 1.0	15v at 2.0A
PF3577	112	56v at 2.0A Fitted with E.S. Shield	28v at 4.0A
PF3783	350	70v, 63v, 56v, 42v, 14v at 5A	35v, 28v, 7v at 10A
		OR	OR
		65v, 58.5v, 52v 40v, 13v at 5A Fitted with E.S. Shield	32.5v, 26v, 6.5v at 10A
PF3784	210	70V, 63v, 56v, 42v 14v at 3A	32v, 28v, 7v at 6A
		OR	OR
		65V, 58.5v, 52v, 40v, 13v at 3A Fitted with E.S. Shield	32.5v, 26v, 6.5v at 6A
PF3785	105	70v, 63v, 56v, 42v 14v at 1.5A	35v, 28v, 7v at 3A
		OR	OR
		65v, 58.5v, 52v, 40v, 13v at 1.5A Fitted with E.S. Shield	32.5v, 26v, 6.5v at 3A
PF3786	2.5	28v at 0.08A	14v at 0.16A
PF3787	2.5	36v at 0.06A	18v at 0.12A
PF3788	120	30v, 27v, 24v, 18v, 6v at 4A	15v, 12v, 3v at 8A
PF3798	60	10v at 6A	
PF3920	100	50v, 43v, 36v, 32v, 14v at 2A Fitted with E.S. Shield	25v, 18v, 7v at 4A



EXAMPLE OF WINDING CONFIGURATION

AUSTRALIAN MADE

AUSTRALIAN MADE

STOCK COMPONENTS

All the transformers listed are suitable for connecting to 240 volts 50Hz mains. Except where shown thus * they comply with clauses 4, 10, 20(b) and 20(c) of Australian Standard C126.
The majority of the transformers have two identical secondary windings which may be series or parallel connected as illustrated.
Types PF2876, PF3783, PF3784 and PF3785 also have a primary tap for extended versatility.

MANUFACTURED BY:—FERGUSON TRANSFORMERS PTY. LTD.
HEAD OFFICE: 331 HIGH STREET, CHATSWOOD, N.S.W. 2067
PHONE: 407 0261. TELEX: AA25728

VOLTAGE—RATING SELECTION GUIDE.

Volts	Amps.	Type No.	Type No.
1.5	1.11		PL1.5-18/20VA
	2.22		PL1.5-18/40VA
	5.33		PL15/40VA
3.0	1.11		PL1.5-18/20VA
	1.67		PL6/5VA
	2.22		PL1.5-18/40VA
	2.67		PL15/40VA
	2.67		PL30/40VA
	4.00		PL30/60VA
	8.00	PF3788	
4.5	1.11		PL9/5VA
	1.11		PL1.5-18/20VA
	2.22		PL1.5-18/40VA
5.0	1.60		PL50/40VA
	2.40		PL50/60VA
6.0	.40	PF2851	
	.83		PL6/5VA
	.83		PL12/5VA
	1.11		PL1.5-18/20VA
	1.33		PL30/40VA
	2.22		PL1.5-18/40VA
	3.33		PL12/20VA
	4.00	PF3788	
	5.33		PL15/40VA
6.3	1.00	PF2315	
	2.20	PF1728	
6.5	3.00	PF3785	
	6.00	PF3784	
	10.00	PF3783	
7.0	3.00	PF3785	
	4.00	PF3920	
	6.00	PF3784	
	10.00	PF3783	
7.5	.67		PL15/5VA
	1.11		PL1.5-18/20VA
	2.22		PL1.5-18/40VA
	2.67		PL15/20VA
	5.33		PL15/40VA
8.5	4.20	PF265	
9.0	.56		PL9/5VA
	.56		PL18/5VA
	1.11		PL1.5-18/20VA
	2.22		PL1.5-18/40VA
	2.67		PL15/40VA
	3.00		PL30-9/40VA
10.0	.80		PL50/40VA
	1.20		PL50/60VA
	1.50		PL80/60VA
	4.20	PF265	
	6.00	PF3798	
10.5	1.11		PL1.5-18/20VA
	2.22		PL1.5-18/40VA
11.5	4.20	PF265	
12.0	.20	PF2851	
	.42		PL12/5VA
	.42		PL24/5VA
	1.11		PL1.5-18/20VA
	1.67		PL12/20VA
	1.67		PL24/20VA
	2.22		PL1.5-18/40VA
	2.67		PL15/40VA
	2.67		PL30/40VA
	4.00		PL30/60VA
	8.00	PF3788	

Volts	Amps.	Type No.	Type No.
12.6	1.00	PF2565	
	1.10	PF1728	
13.0	1.50	PF3785	
	3.00	PF3784	
	5.00	PF3783	
13.5	1.11		PL1.5-18/20VA
	2.22		PL1.5-18/40VA
	2.67		PL15/40VA
14.0	.16	PF3786	
	1.50	PF3785	
	2.00	PF3920	
	3.00	PF3784	
	5.00	PF3783	
15.0	.33		PL15/5VA
	.33		PL30/5VA
	1.11		PL1.5-18/20VA
	1.33		PL15/20VA
	1.33		PL30/20VA
	2.00	PF3559	
	2.22		PL1.5-18/40VA
	2.67		PL15/40VA
	2.67		PL30/40VA
	4.00		PL30/60VA
	8.00	PF3788	
17.0	4.20	PF265	
18.0	.12	PF3787	
	.28		PL18/5VA
	1.11		PL1.5-18/20VA
	1.33		PL30/40VA
	2.00		PL30/60VA
	2.22		PL1.5-18/40VA
	4.00	PF3920	
	4.00	PF3788	
19.0	3.00	PF2440	
20.0	1.00		PL40/20VA
	1.60		PL50/40VA
	2.40		PL50/60VA
24.0	.21		PL24/5VA
	.83		PL24/20VA
	1.33		PL30/40VA
	2.00		PL30/60VA
	4.00	PF3788	
25.0	.50	PF2565	
	.80		PL50/20VA
	1.60		PL50/40VA
	2.40		PL50/60VA
	4.00	PF3920	
	4.00	PF3259	
26.0	3.00	PF3785	
	6.00	PF3784	
	10.00	PF3783	
27.0	1.33		PL30/40VA
	2.00		PL30/60VA
	4.00	PF3788	
28.0	.08	PF3786	
	3.00	PF3785	
	4.00	PF3577	
	6.00	PF3784	
	10.00	PF3783	

Volts	Amps.	Type No.	Type No.
30.0	.17		PL30/5VA
	.67		PL30/20VA
	.80		PL50/40VA
	1.00	PF3559	
	1.33		PL30/40VA
	1.50		PL80/60VA
	2.00	PF2876	PL30/60VA
	4.00	PF3788	
32.0	2.00	PF2876	
	2.00	PF3920	
32.5	3.00	PF3785	
	6.00	PF3784	
	10.00	PF3783	
35.0	3.00	PF3785	
	6.00	PF3784	
	10.00	PF3783	
36.0	.06	PF3787	
	2.00	PF3920	
38.0	1.50	PF2440	
40.0	.50		PL40/20VA
	.80		PL50/40VA
	1.20		PL50/60VA
	1.50	PF3785	PL80/60VA
	3.00	PF3784	
	5.00	PF3783	
42.0	1.50	PF3785	
	3.00	PF3784	
	5.00	PF3783	
43.0	2.00	PF3920	
45.0	.80		PL50/40VA
	1.20		PL50/60VA
50.0	.40		PL50/20VA
	.80		PL50/40VA
	1.20		PL50/60VA
	2.00	PF3259	
	2.00	PF3920	
52.0	1.50	PF3785	
	3.00	PF3784	
	5.00	PF3783	
56.0	1.50	PF3785	
	2.00	PF3577	
	3.00	PF3784	
	5.00	PF3783	
58.5	1.50	PF3785	
	3.00	PF3784	
	5.00	PF3783	
60.0	.75		PL80/60VA
	1.00	PF2876	
63.0	1.50	PF3785	
	3.00	PF3784	
	5.00	PF3783	
64.0	1.00	PF2876	
65.0	1.50	PF3785	
	3.00	PF3784	
	5.00	PF3783	
70.0	75		PL80/60VA
	1.50	PF3785	
	3.00	PF3784	
	5.00	PF3783	
75.0	.03	PF2235	
80.0	.75		PL80/60VA
100.0	.03	PF2235	
125.0	.03	PF2235	
150.0	.03	PF2235	

APPLICATION NOTE: For the optimum choice the following procedure is recommended.

(1) Select construction required, i.e., conventional "PF" or low height "PL".
(2) From selection guide, select nearest value of volts and amps required.
(3) From specification table select transformer with lowest VA rating consistent with values required.

e.g. (1) Required, low height construction rated 18V at 2A—36 VA.
(2) From selection guide either PL30/60VA at 2A or PL1.5—18/40VA at 2.2A.
(3) From specification table, use PL1.5—18/40VA being the transformer with the lowest VA rating.

Solid-state "vibrator" circuit

Mobile radio telephone units, car radios and similar gear with vibrator power supplies, while still in perfect working order, may have to be discarded when the vibrator fails since there are no replacements. This article describes a solid state plug-in replacement unit which is simple to build and very reliable.

by PHILIP WATSON

Like the author, a large proportion of six metre and two metre amateur radio enthusiasts first went on the air using mobile equipment discarded by taxi companies and other commercial users; typically valve units powered by vibrator supply.

Suitably modified, and often "improved", these units performed extremely well and a good many of them are still in operation. The one big query hanging over their owners' heads is what they will do when the vibrators finally fail. For vibrators are a thing of the past. They have not been manufactured locally for something like two years now and, even when they were available, they were not by any means cheap.

Some users have simply bowed to the inevitable and decided it was time to splurge on the much more up-to-date units now available commercially. This is fine, if you can afford it, and if the kind of thing you want is readily available.

Others have sought more modern disposals units, not requiring vibrators, to serve as a mobile unit, relegating the old mobile unit to the shack where it can serve as a base unit operating from the mains. (We will have more to say about mains operation later.) This is fine too, provided you can obtain the unit you want and that you have such a place for the old one.

Another approach is to discard the vibrator supply, or at least the vibrators and transformers, and replace them with a more modern transistorised supply, using transformers wound on ferrite cores. There is no doubt this is an excellent approach, and the smaller, lighter transformer it makes possible has much to recommend it. On the other hand, it represents a fair amount of work; something which might be hard to justify if a simpler approach is possible.

Another suggestion was to add an extra winding to the existing transformers, to serve as a feedback winding, then follow conventional transistor power supply techniques. The writer tried this and found it a perfectly practical approach. A 10 turn winding, five turns each side of a centre tap, was sufficient to ensure reliable oscillation.

The main objection was the need to fit this winding. While it was achieved without removing the transformer from the chassis, by simply removing the covers, it was a rather fiddly job, better avoided if possible.

While discussing the problem on the air, Ross Mudie, VK2ZRQ, mentioned an article in "Radio Communication" for May 1970 describing a transistor circuit which would simply plug in in place of the vibrator, without the need to modify the circuit in any way.

The upshot was the unit about to be described. The work was done on an AWA MR10B; one of the most popular units to find its way onto the amateur scene. At the same time, there is no reason why the idea would not suit most other power supplies designed for vibrators.

The MR10 power supply is, in effect, two separate power supplies on the one chassis. Both deliver a nominal 150V at about 75-80mA. One powers the receiver, and both supplies, connected in series, are used for the transmitter, ie, providing about 300V at 80mA. The power supply also houses the relays to control each power supply, along with the associated valve heater string, plus the fuses, etc. Bias for the transmitter comes from an extra winding on the receiver transformer.

Each circuit uses a non-synchronous, dual interrupter type vibrator in the primary circuit and a bridge type selenium rectifier in the secondary. Whether you intend to replace the vibrators or not, it is a good idea to cast a suspicious eye on these rectifiers. They are both bulky and inefficient by modern standards and, if you do plan to replace the vibrators, you will need some of the space they occupy.

More importantly, it is not generally appreciated that these rectifiers deteriorate steadily over a period of years and it is not surprising to find that, even with a good vibrator, they will deliver significantly less than the expected 150V.

They can be replaced by a bridge configuration of four silicon rectifiers, such as the EM404, or rather more conveniently, but more expensively, by a ready-made bridge, such as the MB4. As well as requiring only a tiny fraction of the space needed for the old rectifiers, these should deliver at least 15V more. (30V on transmit.) If the old rectifiers are below par, the increase may be as high as 25V.

The circuit of the transistor unit con-

The solid-state unit compared with the vibrator which it replaced. In some cases a more compact design may be possible and the factors concerned are discussed in the text. Operating frequency is from 100 to 120Hz.

sists, basically, of a pair of power transistors in a multivibrator circuit, each half of the vibrator transformer primary forming the collector load for each transistor. The collector of each transistor is cross connected to the opposite transistor base via a resistance capacitance network.

The diodes between base and emitter limit the reverse bias applied across this junction during the "off" period of the cycle for that transistor. Otherwise, the reverse bias would exceed the reverse bias breakdown voltage for the base/emitter junction.

While this breakdown may not be destructive (due to the impedance in this part of the circuit), current flow in the base emitter junction, due to any cause, will tend to "turn on" the emitter/collector circuit at a time when it should be turned off. The result, at best, would be highly inefficient operation.

The resistance capacitance network between collector and emitter is a protective circuit, rather than one which is essential to the basic operation. The circuit will work without it but can go into a spurious mode of high frequency oscillation under certain load conditions. To prevent this the capacitance is used to limit the high frequency response of the system. The resistor is simply to limit the surge current from the capacitor through the collector/emitter junction at the moment that the transistor is turned on.

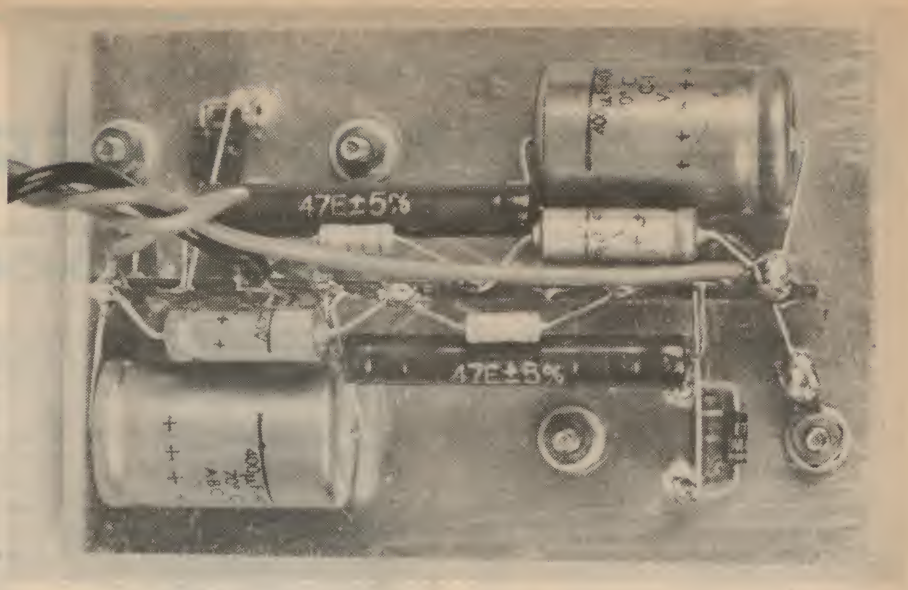
According to the "Radio Communications" article, the base resistors may be calculated on the basis of the required primary current (ie, the transistor collector current), the beta of the transistors and, therefore, the base current required. In general terms the procedure was as follows, in terms of the MR10B requirements.

The primary current may not be known directly but can be calculated with reasonable accuracy from the secondary power. Allowing for the losses in the selenium rectifiers (approx. 15V) the secondary winding will deliver about 165V at 80mA, or 13W. Allowing for a transformer efficiency of, say, 60%, this will call for a primary power of nearly 22W. At a supply of 12V this means a primary current of 1.8A approx.

The transistors chosen were 2N3055s, which have a minimum beta of 20. To provide a collector current of 1.8A such a transistor will need a base current of 1.8/20, or 90mA. At a supply voltage of 12 the resistance needed to pass 90mA is 130 ohms.

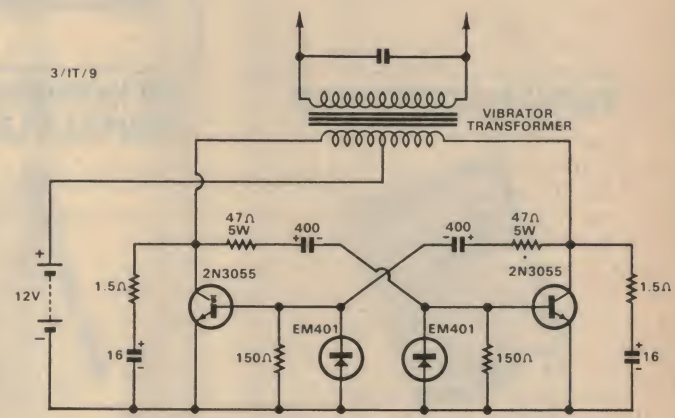
The value of the isolating capacitors in series with the base resistors should be such that their reactance is low relative to these latter; a ratio of one third is suggested.

On this basis a unit for the MR10B should require base resistors of 130 ohms and isolating capacitors of not less than 40uF. We made up a pair of units according to these figures, using 50uF capacitors, and 120 ohm resistors.



Above: Rear view of the unit, showing the symmetrical layout which is possible, though not essential.

Right; The circuit is simple and uses only a few readily available parts. No changes to the existing equipment should be needed.



Initially, results were very encouraging, and each unit worked exactly as expected first time. Unfortunately, they refused to work together as a pair in the series power supply arrangement. While the receiver unit would work normally while in the receive mode, it would drop out of oscillation immediately the press-to-talk button was operated. The transmitter unit would usually start, meaning that the transmitter would operate after a fashion on 150V and incorrect bias.

To ensure completely reliable operation we had to reduce the base resistors to 47 ohms and increase the capacitors to 400uF. The main disadvantage of this arrangement is the relatively high dissipation in the base resistors and the need to ensure that the heat from them does not cause embarrassment. We used 5W resistors mounted as shown in the photographs and have had no problems even with the supply mounted in its original case.

Inasmuch as the MR10B arrangement is a rather specialised one it would be unfair to criticise the original article. In fact, as we confirmed experimentally, the approach is quite valid for a conventional situation. Where only a single vibrator is involved it would still be a good place from which to start, modifying the values only if unreliable starting is encountered.

Normally, a unit will start the first time, unless there is a faulty component or silly wiring mistake, and the presence of normal voltage at the transformer secondary should be sufficient indication that all is well. If a CRO is available check the waveform between either collector and chassis; it should be a clean square wave with a frequency around 100 to 120Hz, varying slightly with load.

At least one of these units has been made, using 120 ohm resistors, and used to replace a defunct vibrator in an otherwise perfectly good car radio. It worked first time and has given no trouble of any kind.

The construction is as shown in the photographs. The components are mounted on a small 16 gauge aluminium panel, which also serves as a heat sink for the transistors. It measures 115 mm x 65 mm and is folded at one end to form a 13 mm mounting foot. One is mounted in place of each support bracket which previously held the selenium rectifiers.

Each one is plugged into the vibrator socket by means of a six pin plug on a short lead. (Plugs from discarded vibrators may be used.) It should not be necessary to change the circuit of the power supply itself and, in fact, the vibra-

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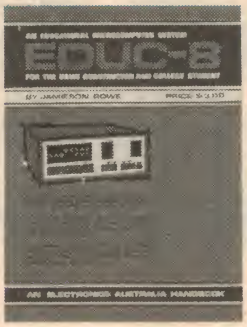

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tor and its substitute should be directly interchangeable. On this basis the vibrator, if it is still functioning, can be retained as a spare in the event that the transistor circuit develops a defect.

The unit is constructed around two tag strips, each with five terminals, sitting end to end. The layout is so arranged that the components around each transistor are mounted symmetrically. This is not a critical requirement, but it does make a neat layout.

(The tag strips used were of an older variety and rather larger than those currently available. Some slight rearrangement may be necessary if smaller ones are used.)

One outstanding advantage of the transistor device, compared with the original vibrators, is that it appears to be notably free from hash problems. The author originally purchased two MR10Bs, one for the car and one for the shack. After conversion both performed essentially the same, except that one had a nasty background of vibrator hash.

A considerable time was spent trying to track this down and every likely component was checked and, in some cases; changed. It was all to no avail and, inasmuch as it was planned to operate the shack unit from a mains supply, we finally gave it best at least temporarily.

Nevertheless, we always had it in mind to try to solve the problem, in order to retain battery operation as an alternative mode. When we were eventually forced to replace the vibrators in the mobile unit we took the opportunity to try the transistor unit in the previously noisy set. Lo and behold, the hash problem had vanished. We subsequently made transistor units for this set also, thus fulfilling the original intention.

On the other hand, there are some restrictions with the transistor circuit compared with the vibrator arrangement. Whereas the vibrator (non-synchronous) is not polarised (active may be either positive or negative) the transistor arrangement must be connected with due regard to polarity. Also, the vibrator will handle any current up to its rated maximum with maximum efficiency, whereas it is advisable to design the transistor circuit to suit the current drain of the particular piece of equipment if maximum efficiency and minimum temperature rise is to be achieved.

At one stage an attempt was made to accommodate all the components on a "U" shaped aluminium bracket, about 32mm wide and 115mm high, sitting on top of a six pin plug. The whole assembly occupied little more space than the vibrator and would fit easily into the same position. The idea worked up to a point, but the heat from the 47 ohm resistors, combined with the crowding caused by the 400uF capacitors, made the arrangement impractical. On the other hand, assuming that the alternative values (120 ohms, 50uF) could be used, this configuration might well be practical.

Earlier, we mentioned mains operation of the MR10B. While this can be achieved in a number of ways, one of the most convenient is simply to feed 12V AC into the vibrator transformer primary. The advantage is that only one minor circuit modification is necessary and even this does not inhibit the set's operation from batteries should it be desirable. Changing over from mains to battery operation, or vice versa, requires only a few moments.

When this idea was originally conceived, we had some doubts as to how the transformers would react. In theory, there are two objections. One is that the transformers were designed for 100Hz operation, rather than 50Hz, and so might run hotter at the lower frequency. The other is that only half the primary winding can be used, since it is a 12V centre tapped winding or, in reality, a 24V winding. Again this might lead to overheating.

A practical test proved these fears groundless. These transformers are "built like a battleship" and apparently just as sturdy. Even after a full day's running, they are not unduly hot.

(The primary winding is so terminated that it would be possible to connect the two halves in parallel, but this would commit the supply to mains operation only.)

The modification concerns the relay circuits. These require DC and this is most easily provided by a suitable silicon rectifier (EM401) and a few hundred microfarads of capacitance. The only restriction is that, if it is intended to be operated in a car, the rectifier polarity must be chosen to suit the electrical system concerned, ie, whether negative or positive chassis.

Apart from this all that is required is to remove the vibrator and strap together pins 1 and 6 (or 5 and 6) of the vibrator socket. This is most conveniently done by means of a 6 pin plug with these pins bridged. An old vibrator base will do and the bridge may be made from 16g tinned copper wire, formed into a small loop to provide a convenient finger grip to aid withdrawal.

Conversion from one mode to the other then involves three steps:

(1) Disconnect existing input plug before opening case.

(2) Remove vibrator and substitute shorting plug, or vice versa.

(3) Replace in case and fit alternative input plug.

A convenient source of 12V AC is a discarded TV power transformer, which usually has two 6V windings of substantial rating which may be connected in series. Since the transmitting duty cycle is normally small, some liberties may be taken with the ratings.

While the above remarks are based mainly on the MR10B, most other vibrator power supplies may be operated from 12V AC in a similar way, assuming they use a non-synchronous vibrator.

Forum

Conducted by Neville Williams

Who said the centimetre was dead?

For dedication and passion, the anti-metrication groupers are matched only by those who want to see the system adopted, right down to the last detail. And, although bitterly opposed to one another, both groups are impatient with those in the middle who are more content to potter along until the rival units are established or discarded by common usage.

Like most popular level journals, "Electronics Australia" took up the median position shared by most of its contacts and its readers. We knew that, inevitably, the posture would annoy some, although certainly not the majority.

To be sure, the Metrication Board set target dates for certain measurements and certain industries but that didn't mean that, overnight, the people concerned would discard the tools, the habits and concepts of a lifetime. The tools, maybe, but certainly not the other two!

In the printing industry, for example, paper sizes, page dimensions, picture sizes, column length and width, advertising spaces and so on have long been keyed to the imperial system and derivatives thereof. The total system has an enormous "momentum"; so much so that, curiously, the "em" equal to 1/6in, seems to have survived metrication—officially! To be sure, theorists could re-express all dimensions in metric measure overnight but, in the real world of printing, too sudden a transition to odd numbers of unfamiliar units would have led to a quite unfunny number of costly errors.

We had to face up, also, to countless components and pieces of equipment, described in countless brochures, and still dimensioned in inches. They had to be fitted into chassis and boxes, with the frustration of transcribing the inch dimensions into metric measure, then having them reverted to inches by the tradesman in the factory still working with imperial measure tools!

We copped our share of criticism, on occasions, for not adopting a harder line, but the critics are welcome to their opinion. It is one thing to be a theorist and crusader, or even a dictator; it is quite another to inter-relate on a practical basis, to two entirely different industries and to thousands of readers, each with their own opinion and prejudice.

In fact, matters have gradually settled into a pattern. With the exception of column widths, still expressed in ems, the dimensions of the magazine itself are in metric measure. All other things being equal, we describe equipment, components, boxes and chassis the same way, although we often show the imperial dimensions in brackets.

Individual writers do this on their own initiative, usually because they (and presumably their readers) still do not have a reflexive reaction to metric terms. For example, the statement that a loud speaker system uses a 200 mm woofer, may not convey an immediate concept to a reader conditioned to other terminology. He has to summon the figure 25, then divide it into 200 to come up with the information that the woofer is neither particularly large nor particularly small—it's just an ordinary 8-inch type!

If a writer inserts the term (8 in), you can argue until further notice whether he's making the reader mentally lazy, or helping the reader build a mental bridge between those two very significant figures in loudspeaker parlance. One thing is certain: for the time being at least, he has made the article easier to read!

But there are occasions, and there will still be occasions, when ordinary imperial measurements occur in our text, with never a millimetre in sight. The reason is a simple convention for which I will share the "blame" with Jim Rowe. The convention is that, if the dimensions in an article or brochure from an outside source are given in imperial measure, we will leave them that way, unless there is good reason to change them. The objective is simply to avoid spending man-hours converting units, when the time could possibly be invested more usefully in other directions.

This does not hide any basic resistance to the metric system. Of all people, those who have spent their life amongst the decimal-related electrical quantities should have the least problem with them. But they are also real people, who have to relate industrially, commercially, socially, and within the family circle; to other people who are used to buying pints of this, and pounds of that, enthusing over yards of something else, and then taking it all back to a house a mile away on a half-acre lot!

You may recall that; a few months ago, we were strongly assailed by some readers for giving certain measurements in centimetres, whereas the preferred convention is to restrict metric quantities to 1000:1 ratios, hence millimetres, metres and kilometres. We didn't feel too guilty about our "lapse" but ultimately gave in, in the face of a mixture of passion and logic. We'd try not to offend, if only to keep the peace!

It was with interest, therefore, that we received this letter recently from a reader in Papua New Guinea:

Dear Sir,

You will recall how, during a recent controversy in your columns, wrath descended upon any who dared to use the evil centimetre instead of the millimetre. It would appear from the enclosed backing card, which held the blade for a filing tool, that this is a hang-up, and a product of English-speaking bureaucracy.

As will be evident from the card, centimetres are apparently acceptable and normal if you happen to speak German, Dutch, Danish, Norwegian, Swedish, Spanish, Portuguese, Italian and French. Only the English instructions mention millimetres; and woe-betide the English-speaker who ventures into centimetre land!

It is true that the English instructions show an extra 0.4mm accuracy—25.4mm to the inch compared with 2.5cm shown

What do we call this fellow? Centipede or .035 kilopede?

in all other languages—but this only adds to the peculiarity of the whole bit. It certainly doesn't explain why a unit apparently useful in a variety of other languages is frowned upon only in English!

It is enough to make you carry a standardschnitt, or wield a well balanced vakioleikkuutera both 25 centimetres, of course!

A.S. (Konedobu, PNG)

I imagine that A.S. typed his letter with as much suppressed amusement as I duly read it. How utterly irreverent for a world supplier of tools, not only to equate his product to the imperial inch but to do so, in all but one language, per medium of the centimetre!

But, seriously, I wonder whether the particular company is being anything but entirely practical. I wonder whether the millimetre, after all, is just too small to be used as the basis for mentally assessing dimensions.

Most people, and particularly tradesmen, take some pride in their ablility to assess dimensions to within a few percent of the measured figure. They judge an inch, then step it out visually to come up with their assessment: 6 x 3 x 2 &c. Maybe it's just the long familiarity, but an inch does seem to be a very convenient unit for this purpose.

But the millimetre? It's just too small to use that way. Try judging a millimetre and then visually proportioning another 99 of the little brutes.

What I suggest that most people would tend to do, in mentally judging metric dimensions, would be to work in larger lumps—say 10 millimetres long—which they can visualise. The answer would then emerge as so many "lumps" of length, width and height. To be sure, the lumps could be considered as tens of millimetres and the estimate arrived at accordingly, but is it the logical thing to do?

It might seem just fine for those mathematically inclined but I wonder about the tradesman. I wonder whether the real explanation for "lumps" equated to inches and centimetres in all those languages isn't an intuitive preference for units that are big enough to visualise.

Perhaps the centimetre has a certain subjective validity after all, despite all the arguments of those who see it as redundant, confusing and generally undesirable.

As if to add to the case for, I happen to be reading a copy of the Australian Financial Review during my lunch break, just ahead of writing the foregoing paragraph. In an article dealing with VHF communications to parallel the Moomba /Sydney natural gas pipeline, distances were given in kilometres and other dimensions in centimetres!

How large is an 86cm pipe? Surely not too hard to visualise directly and one mental step less than resolving 860mm. Of course, if you want to cheat a bit with centimetres, knock off the last figure,

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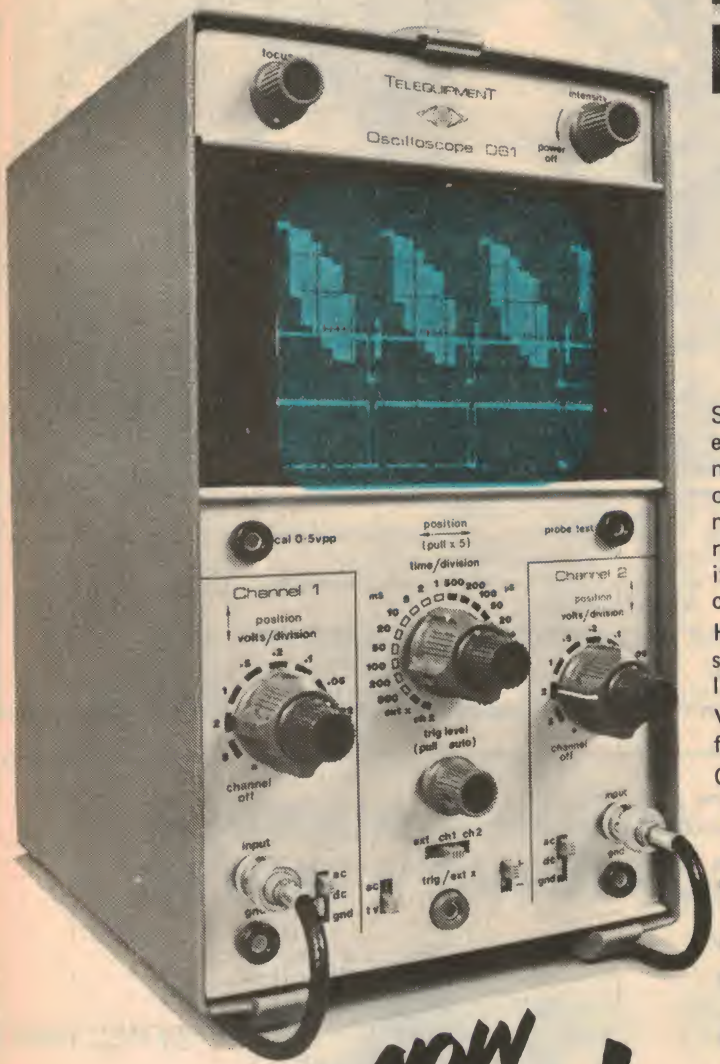

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multiply by 4 and call the result inches: so 86cm is a bit bigger than 32 inches.

You have the horrors—all you champions of the millimetre? Don't lose any sleep, because we have no plans to embark on a "save the centimetre" campaign. But at the same time we have no intention of treating the millimetre as some kind of a sacred cow.

In the meantime, as I read adverts for 53cm TV sets and wear 43½cm shirt collars, I wonder whether the centimetre is going to need saving!

To change the subject, the letter in the panel regarding transformerless colour TV receivers is one of a number of reactions to our "Forum" article in the August issue. Some of the other letters are of a more general nature and we plan to use them later in a survey of colour television '75.

Colour TV sets

Dear Sir,

I read with interest the article: Forum Aug '75, "Why the ban on some colour TV sets?". In particular, I noted Neville Williams' remark that a DC flow of 700mA through the primary would cause so much core saturation that something like a 750W transformer would be necessary.

I do not dispute this.

What amazes me , is, that he overlooked what to me seems to be the obvious answer:

My suggestion is to use a 240/240V isolating transformer with a full-wave bridge rectifier. This will solve the "non-symmetrical load to the mains" problem, and the DC effect will be eliminated too.

There is no need to modify the TV set. The half-wave rectifier merely acts as a protective diode in the pos. HT rail.

All we need is an isolating transformer that can handle the set's power requirements plus 4 silicon diodes at $0.20 each.

C. H. (Ingle Farm, S.A.)

Of more immediate interest, this one suggests a possible way around a potentially embarrassing situation for those who own transformerless colour TV receivers with half-wave rectifiers. As we pointed out in the earlier article, these receivers are officially unacceptable to many supply authorities in Australia because they cause direct current to flow in the mains supply system. This can make things difficult for distribution transformers and, as well, it can cause serious electrolysis in underground metal pipes and structures.

Superficially, it seemed that, for such receivers to be acceptable, they would either have to be modified, or else used with an external isolating transformer of acceptable design and large enough to cope with the DC effect within its own secondary and core. A 750W transformer costing in the region $80 to $100 seemed to be indicated.

So to the suggestion by C.H.

I cannot say for sure that it's original but I can say that no one came up with it in any of the discussions we had with representatives of the industry or supply authorities. It certainly warrants closer study, although I doubt that it would provide quite as simple an answer as C.H. seems to imply.

One engineer, with whom I discussed the matter, pointed out that the figures 200W and 750W would themselves need to be analysed. A 200W step-down transformer may be quite adequate for a 200W resistive load but it might not be appropriate for a "200W" television receiver because of the pulsed load waveform created by the rectifier system—be it full-wave or half-wave. In short, it's not simply a matter of the label on the transformer but whether it will carry the load of a TV receiver without overheating.

A critical point about C.H.'s suggestion is that the introduction of a full-wave rectifier would double the number of charging pulses into the receiver's filter. While these pulses also have to flow through the original rectifier, there is a strong chance that the voltage on the receiver's supply rail would be increased by the modification.

From this, vital questions emerge: what voltage would need to be fed into the bridge rectifier to maintain the correct DC rail potential? Again, would this rectified voltage be appropriate for any branching heater circuitry in the receiver, or would a separate connection to the mains need to be provided?

These remarks are not made to knock the idea, as such, but to act as a caution to those who might be tempted to take C.H's suggestion too literally: rush off to buy a 200W transformer and a bridge of rectifiers—and connect 'em up! Our advice is: don't, unless you're in a position to analyse and arrange exactly what is needed by the individual receiver involved.

This would not be a problem for a manufacturer who may want to provide an add-on unit for specific models, because he would be in a position to devise and prove the design. However, the manufacturer would almost have to seek type approval as an "appliance" and solve the ticklish problem of how to market a product that would look superficially like 1:1 transformer, with 3-pin input and output, yet in fact be a unit designed to complement a certain model TV receiver.

It could even be that the apparent economies of C.H's suggestion would disappear behind a smoke screen of such complications. But it's an interesting thought, nevertheless.

Improving sound from 9.5 & 16mm projectors—1

Optical/magnetic preamp

Here is the first of three short articles dealing with ways of obtaining improved reproduction from optical sound tracks on 16mm and 9.5mm movie films. The author introduces the subject by discussing the use of silicon photovoltaic cells, and describes an up-to-date transistor preamp circuit.

by JAMIESON ROWE

As many of our regular readers will have guessed by now, movies have long been an interest of mine. And with a background in electronics, I suppose it's natural that one aspect of movies which has often attracted my interest is the sound track and its reproduction.

The problem of obtaining satisfactory sound reproduction from optical sound tracks on 16mm and 9.5mm gauges is one I have found particularly absorbing. This has never been an easy one to solve, and all sorts of schemes have been evolved. I myself have tried to contribute a few ideas in the past, with articles published in the February, 1961 and April, 1967 issues.

The second of these articles described a solid state preamp, intended to allow updating of elderly valve equipment. It was developed around my own 16mm projector, an elderly but still quite serviceable model 156 Bell and Howell. The preamp incorporated voltage regulation for a gasfilled photocell, and generous treble boost to compensate for cell and sound track losses.

At about the time the preamp was being developed, silicon photovoltaic diodes appeared on the market at reasonable cost, and I was able to give brief details of the way in which one of these could be substituted for the gas photocell. However, not much information was available at the time on the optimum use of the silicon diodes, and as a result the details I gave were purely on the basis of a few hasty experiments.

The 1967 preamp was capable of quite good reproduction from most optical tracks, and judging from reader letters a fair number were built up. But inevitably it wasn't capable of coping with the very worst tracks, and in addition it had a problem due to the use of one of the early p-channel junction FETs in the input stage.

The preamp was designed before we realised how much the very wide parameter spreads of these devices limited circuit design. As a result, some builders had trouble in getting the preamp going, being unlucky enough to get a FET with very different parameters from that used in my original unit.

It was evident, then, that there was plenty of room for an improved preamp design. One which made optimum use of silicon photodiode, avoided the FET problem, and would hopefully be able to give better reproduction of poor sound tracks.

What was needed was the impetus to do more work along these lines. This came a couple of months ago, when I came across a 16mm print with a really terrible sound track—the contrast was so poor that the signal was almost buried in noise. Yet because no better print was available of the classic old film concerned, it was either try to reproduce it, or go without!

So I set to work not only to see if the preamp couldn't be improved upon, but also to have a look at other ways of getting better results from really poor tracks. These articles are the result.

The first thing I looked at was the silicon photodiode. In the 1967 preamp, this was fed directly into the high input impedance of the FET input stage. Quite possibly this was not the best arrangement to use for these devices.

Reading through some up-to-date literature on the subject confirmed this. Basically a silicon photodiode is a current generator, which gives its most linear output when fed into a very low resistance load. High load resistances tend to cause compression of the dynamic range and peak distortion, as well as limiting high frequency response. This is shown in Fig. 1.

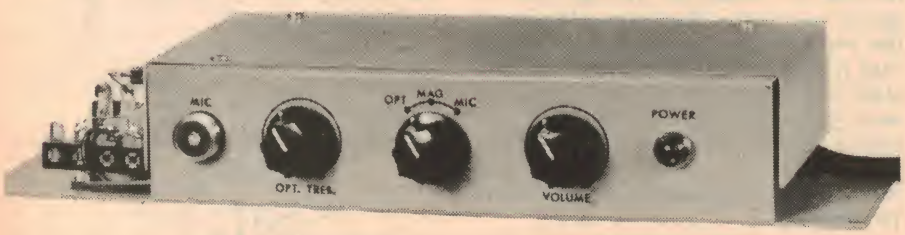
The most linear output would be obtained by feeding such a diode into a shortcircuit, but this wouldn't give the preamp much signal voltage to work on! Happily it isn't necessary to go to this extreme; all that is required is a load resistance small enough to ensure linearity up to the maximum illumination level concerned. If this is the level Emax shown in Fig. 1, for example, a load resistance of 1k would be adequately low.

There is no point in using a load resistance lower than that necessary to give linear output, because this will merely reduce the output voltage available for the preamp, and degrade the signal to noise ratio. Hence there is a well-defined optimum value for load resistance, to give maximum signal output with minimum distortion.

This optimum load resistance value depends, however, on the maximum illumination level of the diode. The higher this level, the lower the optimum load resistance.

The maximum illumination level depends in turn mainly on the projector exciter lamp output, and the sound scanning optics. Strictly it will correspond to the total light reaching the diode when the sound track is at minimum density —i.e., clear film.

In practice the easiest way to arrive at the optimum load resistance seems to be by direct measurement. The measurement is made with the photodiode mounted in its correct operating position in the projector, with the exciter lamp on but without any film threaded. This gives



The author's preamp is built in a box designed to fit inside the case of an elderly Bell and Howell machine. However any other suitable box could be used, as desired, or to suit another projector.

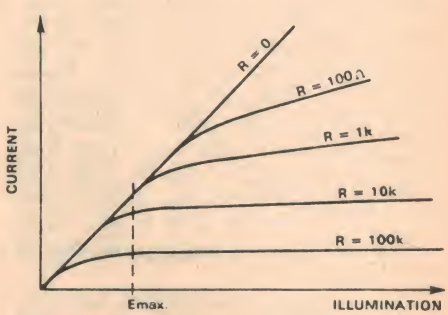


FIG. 1 PHOTOVOLTAIC DIODE CHARACTERISTICS

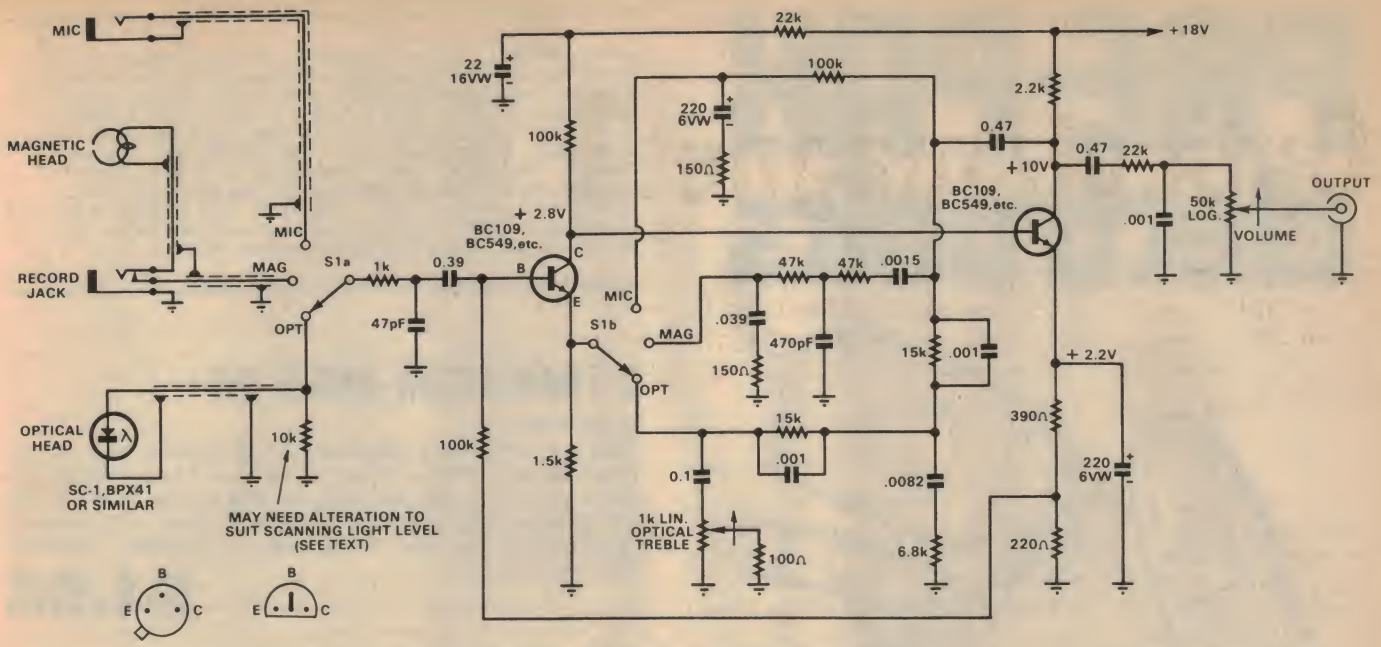


FIG. 3 **16mm OPTICAL/MAGNETIC FILM PREAMPLIFIER** 1/PRE/30

The circuit of the updated preamp is shown above, with the diagram at right illustrating the way of mounting of a silicon photodiode.

a light level slightly above that which will ever be reached with a film present.

With the diode thus illuminated, you simply connect a sensitive microammeter across its output, in series with a variable resistor of 100k or thereabouts. Then slowly reduce the value of the resistor, and note the value at which the current reaches a plateau—with further reduction in resistance producing no significant increase. This then is the optimum load resistance. With my old Bell and Howell machine and a Plessey SC-1 photodiode, it proves to be very close to 10k.

When fed into its optimum load resistance, a silicon photodiode gives very much better performance than the conventional gas photocell. It has better frequency response, lower distortion and noise, and does not require a polarising supply. It is also insensitive to mechanical vibration—i.e., it is not microphonic. Working at a much lower impedance it also tends to obviate most of the hum problems encountered with PE cells.

By substituting a silicon photodiode for an existing gas PE cell you can therefore make quite a significant improvement in the quality of reproduction. The main point is to mount the diode so that it collects as much of the scanning light as possible, despite its somewhat smaller size. This usually means mounting it somewhat closer to the film than the original cell.

The exact mounting arrangement will depend upon the projector concerned. The scheme I used with the Bell and Howell machine is shown in Fig. 2, and you may be able to use a similar arrangement.

To my knowledge there are at least two silicon photodiodes available which are suitable for the job. One is the Plessey SC-1, mentioned in the original article, and available from the Components Division of Plessey Australia. It comes in either chip form, with flying leads, or in a modified TO-5 package with end window. The latter is more rugged and would perhaps be easier to mount in some cases, but it is also somewhat more expensive.

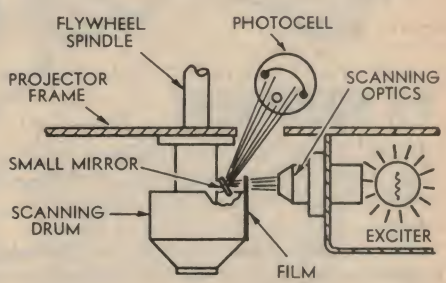
The other device is the Philips BPX41, available from the Elcoma division of Philips Industries. This normally comes in chip form, with flying leads.

Philips also make a larger device, the BPX42, which may be worth considering where it is difficult to position the diode close enough to the film to collect most of the light. This device has about 4 times the active area of the other two.

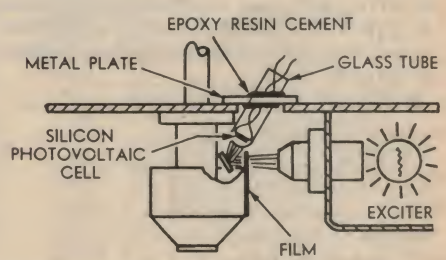
There is no reason why one of these diodes cannot be used with the 1967 preamp, providing it is shunted with a resistor to give the optimum load resistance. However in view of the trouble with FET parameter spreads, I have revamped the original preamp circuit to produce a more straightforward and up-to-date design. This is shown in Fig. 3.

As you will see if you compare this circuit with original, the main difference is that bipolar transistors are now used for both stages. In fact the basic preamp configuration is now the same as that used by Leo Simpson in his mixer unit described in the February and March issues. It uses two low-noise high-gain NPN transistors type BC109, BC549 or similar.

As before, the circuit is provided with switching to select operation from the optical photodiode, a magnetic stripe head, or a low-to-medium impedance dynamic microphone. The feedback



ORIGINAL OPTICAL SYSTEM



MODIFIED OPTICAL SYSTEM

constants are switched at the same time to give the appropriate gain and response characteristics.

The feedback constants for the magnetic head and microphone modes are basically the same as before, and need no further explanation. However, the constants for optical mode have been altered, mainly in order to reduce the gain of the preamp above the maximum frequency available from most sound tracks.

As there is virtually nothing recorded on a 16mm optical sound track above about 7kHz, there is no point in having the preamp provide significant gain above this frequency. In fact there is a definite advantage in reducing the gain at higher frequencies: reduced noise.

This is the purpose of the .001uF

(Continued on page ?)

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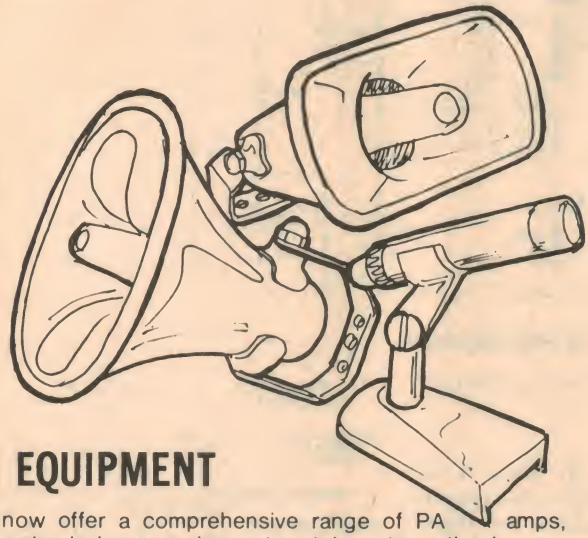

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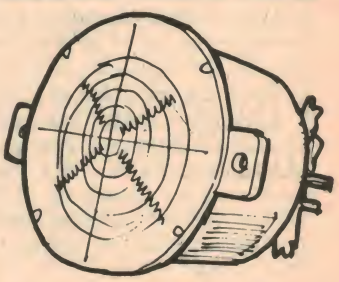

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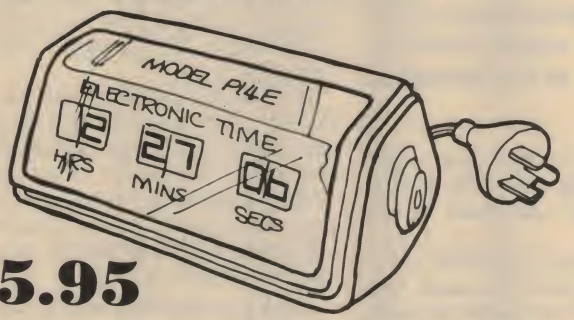

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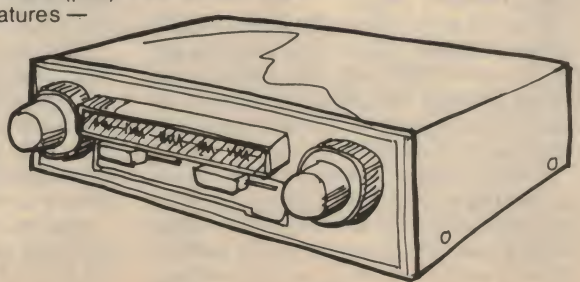

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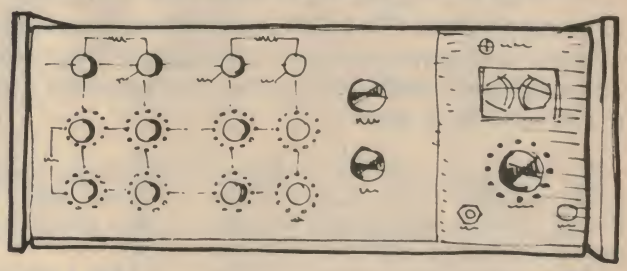

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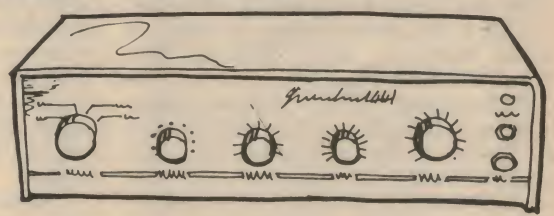

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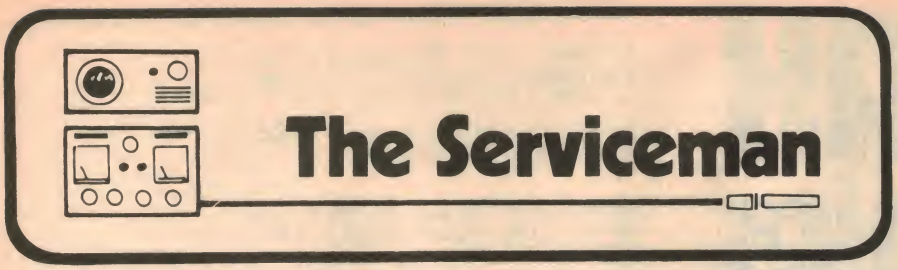


A routine fault that wasn't

Every once in a while what looks like a routine fault turns out to be anything but that. This was emphasised by a recent job in which quite ordinary symptoms turned out to have a most unusual cause. Another job presented a different puzzle; just how did it come to be damaged in the manner it was?

The first story concerns a General Electric portable TV set, fairly old, but, in most respects, still capable of a very good performance. The one fault concerned the vertical circuit, which needed something like 10 to 15 minutes after switching on before it would stabilise.

If the hold control was adjusted when the set was switched on it would lose hold almost immediately and would continue to need readjustment at half to one minute intervals for the next 10 to 15 minutes. After that it would settle down and need no further attention while ever it was kept running. But once switched off and allowed to cool, it would need the same warm-up time when switched on again.

As the owner had found, it was easier to ignore the hold control, switch the set on about 15 minutes before it was needed, and let it settle down of its own accord. This was not always convenient, but neither was it convenient to stand by the set and twiddle the hold control for the first 15 minutes of a program.

I didn't regard the problem as anything special when the owner described the symptoms; it's a common enough fault. The usual cause is a faulty vertical oscillator valve, often the triode portion of a triode/pentode value, with the pentode section as the output stage. Typical types are the 6BM8 or 6GV8 and both are notorious for this fault, the 6GV8 being particularly bad.

This circuit used a triode/pentode in a similar manner, except that it was neither of these valves. The set used the "Compactron" type valves; rather rare devices in this country which I have mentioned before in these notes and which, by reason of their very rarity, often present problems when one suspects they may be faulty.

Such was the case in this instance. I suspected the triode/pentode—a 17JZ8—but without a replacement on the shelf I was at a distinct disadvantage. I could buy one, but this would take time and was relatively expensive. On top of that there was a risk that the valve might not be faulty, leaving me with a rare valve which I would most likely never use.

Then I remembered. I did have such a valve; a discarded one to be sure, but one which might still be good enough to confirm my suspicions. Having fished it out, I switched the set on and let it warm up with the original valve still in place. When it finally settled down I pulled out the suspect valve and substituted my own.

When it warmed up the picture locked in perfectly; a pretty good indication that the problem was somewhere other than in the valve. Just to make sure I let the set run for half an hour or so until the original valve had cooled, then put it back in the set. Once again the picture came up locked; convincing proof that the valve was not to blame.

This last trick could possibly have been performed without a replacement valve, except that these sets use a series heater string, and I had to use something to keep the heaters alight. Failing all else it might have been possible to substitute a resistor of suitable value except that (1) I didn't think of it and (2) it would have been a lot more difficult to arrange than simply plugging in another valve.

Anyway, having proved that point I now had to decide what else might cause the trouble. It seemed pretty obvious that it would be a component in the vertical oscillator section and, since there were not many of them, I imagined it would be fairly simple.

In fact, it turned out to be one of those awkward fiddly jobs which seem to go on for ever. Although the circuit was simple enough, the physical location of many of the components made access to them far from simple.

To make matters worse, I didn't seem to be getting anywhere. Since the fault was obviously heat sensitive, I first tried heating each component with a soldering iron while watching for any change in oscillator frequency. This yielded nothing.

Next I tried the opposite approach; cooling each component. Unfortunately, I had run out of "canned cold"—those handy aerosols which will put frost on a component in seconds—and was forced to fall back on that old faithful, methylated spirit.

With a small brush I wet each component in turn, hoping that the lowered temperature would upset the oscillator. Again I drew a blank.

That is, until I accidentally deposited a drop of metho on a clear part of the printed board; a spot where it could not possibly come in contact with either a component or any of the copper conductors. Suddenly the vertical oscillator went mad and I knew I was on to something.

But what? Leakage across the board? Perhaps, but why? Now that my attention was drawn to it I realised that the board had a faint coating of dust—not a great deal and certainly no more, if as much, as is often found in a set this old. But it did seem to have a slightly greasy base, embedded with grime.

I lost no time in getting stuck into the board with more metho and a larger brush and soon had it sparkling clean. Then I checked the set again. From cold, after the initial adjustment, the vertical hold never even flickered. To make sure I put it through several cycles over the next few days, but I couldn't fault it. As far as I was concerned the point was proved.

Apart from being an interesting story in itself, and one which I hope might save someone else some time, it raises an interesting question. How prone are printed boards in general to this problem? What was the source of the grease which trapped the grime and dust?

One suggestion is that it was an environmental problem. I have known—and written about—cases where kerosene room heaters caused enough contamination to upset the switching contacts in a tuner. Or had it been used in a kitchen where cooking fumes were present? Or was it a faulty coating on the board in the first place?

Whatever the answer it does raise the question as to whether this is likely to be a common fault now that virtually all sets use printed boards. Will today's sets, when they reach the age of this one, have accumulated enough grime to upset their behaviour? And not only in the vertical oscillator section.

One bright spot is that such leakage is small and less likely to affect the low impedance circuits in modern solid state sets. On the other hand, not all solid state circuits are automatically low impedance, nor will they necessarily remain so in future designs.

Anyway, that's what I found. Perhaps someone else can throw some light on this kind of fault.

My second story concerns a quite

modern portable record player; a fairly elaborate unit complete with three band tuner, stereo amplifier, cassette deck, and a pair of detachable speakers which normally formed the lid of the carrying case. Although it carried a well known brand name, I had not seen anything quite like it before and subsequently learned that the owner had purchased it during an overseas trip.

And, although basically a portable unit, I gathered that he considered its performance good enough to justify it being given pride of place in the loungeroom as his main source of musical entertainment.

When the owner brought it to me he complained simply that, "It won't go". As it turned out, his description was rather more accurate than it appeared, inasmuch as "it" was the turntable—and "it" certainly wouldn't go; it was jammed tight, in fact.

More precisely, the turntable could be rotated by hand, but only by exerting considerable force on its edge. At this stage I could not determine whether the drive mechanism was jammed against the inside rim, or whether the idler shaft was jammed in its bearing.

How had this happened? Apparently a visitor was to blame. The owner had asked him over for an evening's session of records and tapes and all had gone well until around supper time. Then the host and his wife had both left the room briefly to attend to some minor crisis concerning the refreshment.

When they returned the visitor rather sheepishly explained that something seemed to have gone wrong with the player; that it wouldn't play records any more. As can be imagined, it was a rather embarrassing situation. The host suspected that the visitor knew more than he was telling, but could hardly say so. The visitor, for his part, must have sensed that his host did not fully accept the idea that the fault had "just happened" and, all in all, it wasn't a very successful evening.

I started by removing the circlip which held the turntable to the idler shaft. That done I tried to lift the turntable clear, but it seemed unwilling to move. For the next half hour I tried in vain to free it, becoming more and more convinced that there was a retaining device somewhere which I had overlooked. And, for this reason, I hesitated to exert too much stress for fear of breaking something, particularly the plastic motor board on which the whole thing was mounted.

Then suddenly, when I had almost given up hope, it came free. Heaving a sigh of relief, I checked the mechanism. The motor and drive pulleys which engage the inside edge of the turntable appeared to be intact and functioning normally. In fact, it was the idler shaft that was jammed.

But what had caused it remained a mystery. I formed the theory that something quite heavy had fallen on the turntable, driving it hard onto the shaft (hence my struggle to get it off) and also, most probably, bending something out of alignment at the same time. Hence the jammed shaft.

If the theory was correct I had problems. First the whole motor would have to come out, something I didn't relish in a device as compactly constructed as this one. Then there was the question of replacing the faulty part; would the local agents have one?

While musing thus I slipped the turntable back on and pressed it—gently—down on the taper of the shaft. Then I tried rocking the turntable gently to and fro. To be quite honest, I wasn't quite sure whether I was turning the turntable on the shaft or the shaft itself. Before I could work it out there was a "click" and the turntable and shaft spun freely.

What was more, the turntable appeared to be running perfectly true. I engaged the motor drive and everything appeared to function normally. How had I done it? Frankly, I haven't the slightest idea. It just happened and I was duly grateful.

As a final check I slipped a record on the turntable and lowered the head at random onto the surface. The result was a weak and dreadfully distorted signal; so distorted that I imagined that the record was being torn to pieces.

As it turned out this was probably true (the record was an old one anyway) because, when I lifted the head and took a good look underneath it there was no stylus to be seen; just a broken end of the stylus arm. So here was a fault which neither the owner nor I had any idea existed. I wondered just how much more damage I would find.

Fortunately, the stylus did not present a problem. It was a well known type and a replacement was readily available. When that was fitted the system came good and, as far as I could determine, there was no further damage.

But how had it happened? I still favour the idea of some heavy object falling on the set, but I now think it probably landed in the pickup head, twisting the stylus arm and jamming the turntable in the one operation. And in a panic the visitor attempted to straighten the bent stylus arm, only to have the fragile piece of metal break off completely. After that the jammed turntable captured everyone's attention, including mine.

It so happened that I was able to return the unit to the owner's home, it being on the way to another job. This gave me an opportunity to see where it was normally placed and judge what chance there was of something falling on it. It transpired that there were two shelves along one wall of the loungeroom, the lower one being used for the player, records, tapes, etc., and the one above it for books. I may be wrong, but I imagine that some of those books could solve the mystery, if only they could talk.

The mouse that roared (in SSB)!

Upgrading the Tucker Tin SSB transmitter

Originally described in the February, March and April 1972 issues of "Electronics Australia," the Tucker Tin Mk 2 SSB transmitter has proved a popular project with radio amateurs. Here the author, himself a radio amateur, relates his experiences in constructing the Tucker Tin, and details several design improvements.

by PETER R. JENSEN, VK2AQJ*

After constructing the "Tucker Tin" SSB transmitter some 12 months ago, the author experienced a considerable lack of success in getting it on air.

In retrospect this difficulty was probably due more to operator inexperience than to deficiencies in the Tucker Tin. Nevertheless it was quite obvious that considering the number of stations running well over 100 watts, a rig running 4 watts was not going to make much headway despite the few 'S' points difference. It was accordingly decided that what was required was greater power output and the achievement of this was tackled in two stages.

The first stage involved some alterations and additions to the original Tucker Tin chassis, particularly to the power amplifier. As indicated in the accompanying schematic an 807 was included as a new output tube (and a future driver for a linear amplifier) together with its own power supply. Fortuitously the original chassis design for the Tucker Tin had not been followed (as photos indicate) and there was sufficient space to include the new tube, a mains transformer, bias transformer, relays etc on the existing chassis.

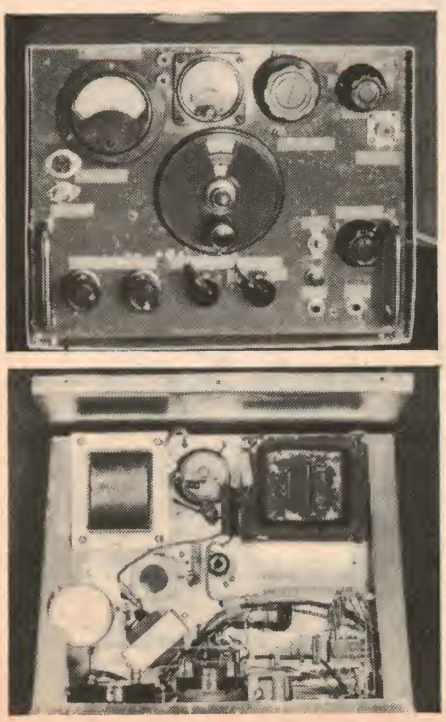
A vital part of this revision to the basic design was to incorporate receiver muting and aerial changeover so that full advantage could be taken of the station antenna in the receiver.

A standard PMG relay was used, powered from the unused 5V filament winding and appropriate rectifiers and capacitors. Its first function was to switch the leads from the original transmitter key jack. Additional functions were to key the cathode ground connection to the 807; to change over the antenna from receiver to transmitter and to earth the receiver input on transmit; and finally to provide receiver muting.

In passing it should be noted that the 5MHz trap included in the tank circuit of the original Tucker Tin was dispensed with—with the new stage it proved to be unnecessary.

Another essential part of the first stage of the modification program was then undertaken. The author discovered that in order to fully modulate the signal, using the Japanese manufactured dynamic microphone available, an addi-

*7 Union St, Mosman, NSW 2088.



The revised power amplifier incorporates an additional stage (807) and has provision for aerial changeover and receiver muting. At left are two views of the modified Tucker Tin SSB transmitter as constructed by the author.

tional microphone preamplifier stage was essential. A preamplifier was made up in accordance with the circuit shown, and this stage precedes the original microphone preamplifier described in February, 1972. This arrangement appears to provide quite sufficient output to the modulator without it being necessary to shout.

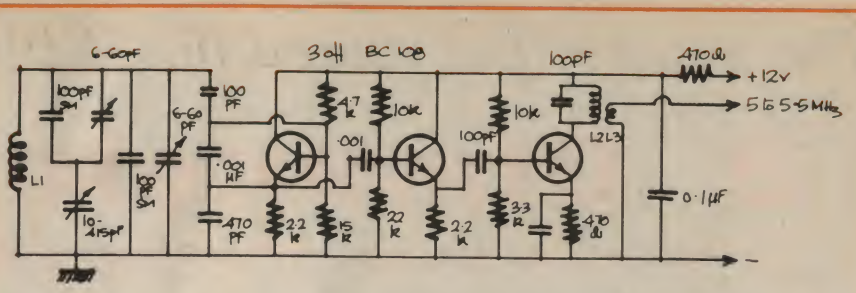
Having got all the previously described changes to work, "on air" tests revealed one further serious deficiency—frequency instability.

After considerable pondering and probing around with a multimeter the reason for the wandering signal became abundantly clear. Despite the fact that both the VFO and the crystal oscillators run continuously, switching from receive to transmit (ie switching on the mixer) caused the supply voltage to the VFO to drop by nearly 2 volts.

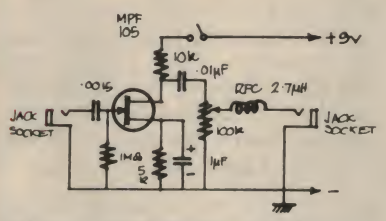
At first, the solution to this problem seemed quite simple—stabilise the power supply and, hopefully, the VFO frequency as well.

Initial experiments included the use of zener diodes, an IC voltage regulator and, finally, a separate voltage doubler power supply fed from a spare set of 6.3 volt leads on the power transformer. In addition, the supply to the drain of the VFO FET was detached from the supply to the adjoining buffer so that the new power supply would feed the VFO alone. This latter step involved some fairly brutal surgery to the VFO circuit board.

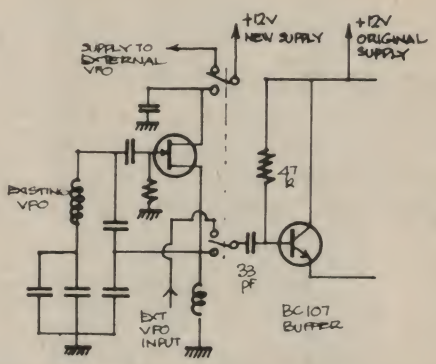
While these efforts certainly improved the situation, the author was still left with a 1kHz VFO drift which made net operation impossible and rendered even a normal contact difficult. At this stage, it was decided to abandon further efforts with the existing VFO and, instead, concentrate on building a new design externally. This approach was to prove entirely successful.



Circuit diagram of the "Synthetic Rock" VFO. Coil winding details are as follows: L1 20 mm diameter ceramic former, 30 turns 28B&S spaced over 50 mm; L2 30 turns 28B&S close wound; L3 5 turns 28B&S wound over earthy end.



Above, circuit diagram of the new microphone preamplifier stage.



At right, switching arrangement for selecting either the internal VFO or the external VFO.

The circuit chosen for the new "external" VFO was originally described in "Electronics Australia" in October 1966, and is based on the so-called "Synthetic Rock" circuit designed by Commander P. H. Lee. Construction followed the general description given in EA, the only unusual item being the use of a grooved ceramic coil former. The relevant coil details are shown in the accompanying circuit diagram.

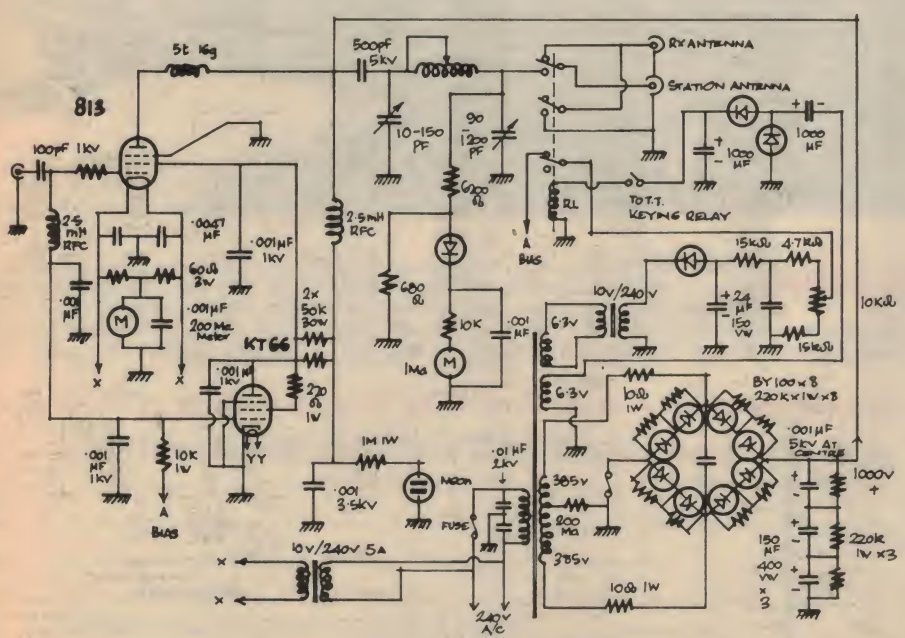
The coil former itself was salvaged from elderly transmitting gear and, being rigid and dimensionally stable with temperature change, is ideally suited to its new job. A modern substitute could well be a suitably sized pyrex glass test tube from the local chemist.

The external VFO is powered by the same supply that feeds the original internal VFO, which has been retained for emergency use. The respective VFO power supply rails and signal outputs are switched by a DPDT switch as shown in the circuit diagram. Signal output from the VFO in use is injected into the existing VFO buffer by means of the 33pF capacitor to its base.

At the time of writing, the new external VFO has been operational for only a few months. However, the evident stability of the unit on air has, in the author's opinion, more than justified the additional effort required to construct it.

The second stage of the modification program, a "linear amplifier," involved nothing novel so far as the circuit was concerned. Indeed for the more acute readers the circuit will no doubt appear somewhat familiar, if only in parts. For the various parts refer to EA April 1967 p81 and EA April 1962 p65. The only novelty is the way the bits have been put together.

The power transformer was gleaned from an old television set and a number of high voltage components from an elderly naval RF power amplifier. The output tube is an 813 which is still available, in Sydney at any rate, and the clamper tube a KT66 which is far cheaper than the originally recommended KT88. The



Above is the circuit diagram of the author's linear amplifier. The circuit was adapted from two previous designs published in April 1962 and April 1967.

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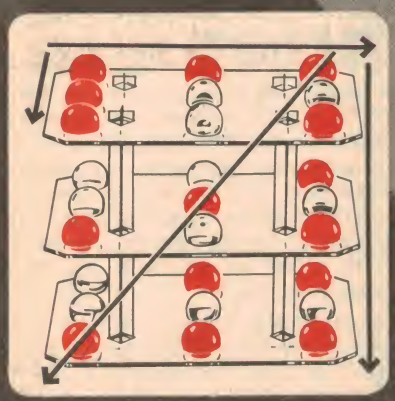

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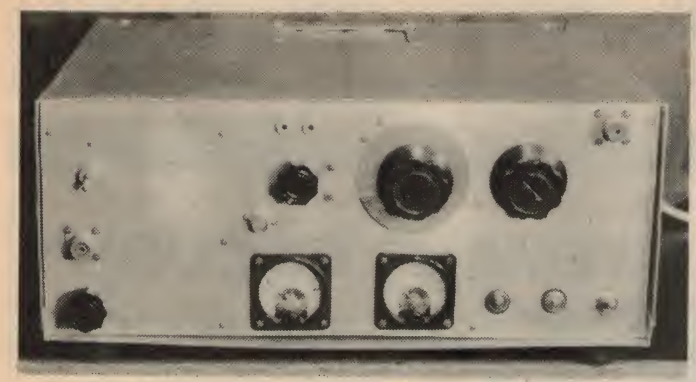
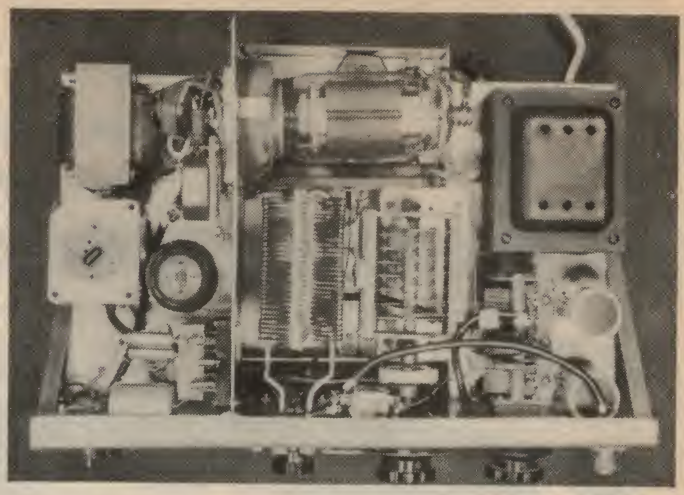
Upgrading the Tucker Tin Mk II



A view of the completed linear amplifier. The meters shown monitor RF output and output tube cathode current.



Internal view of the completed linear amplifier. The 813 output tube is situated at top.

filament transformer for the 813 is available from Ferguson Transformers and supplies 5 amps at 10 volts.

Normal RF techniques were employed and the device worked first time. This was probably because the author was very careful in wiring up, not fancying the idea of trouble shooting a defective project with 1000 volts floating around. Apart from the question of high voltage there would seem to be a moral there.

Finally a caveat. Despite the fact that the afore described modified rig is regularly heard on 3.62MHz and seems to put out an entirely acceptable signal, the author is an amateur and not an electronics engineer. The project was thus largely assembled and made to work on a cut and try, suck it and see basis. For this purpose a lot of meters, evident in the final equipment, and an oscilloscope have been essential.

The author cannot guarantee that the modifications will work for anyone else or take any responsibility for anyone who misjudges the lethal potential of 1,000 volts at 150 milliamps. With that comment the author will look forward to meeting any other amateur who runs the Tucker Tin, modified or otherwise.

Video switcher-fader: addenda

In the February 1975 edition, we published full circuit details of a video switcher/fader unit for ATV and CCTV. Here the author details several design modifications and gives additional notes on operation.

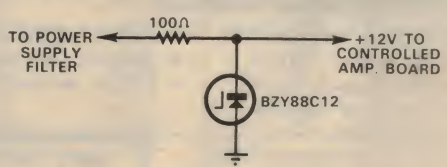
by IVAN G. REPIN (VK2ZOQ/T)

Since preparation of the original article on the video switcher/fader unit (Electronics Australia, February 1975), further experience with the prototype has revealed several minor design shortcomings.

Perhaps the most serious of these shortcomings is hum in the controlled amplifiers when more than two lamps are alight, due to poor power supply regulation. This is due to the current drain exceeding a level above that which the filter capacitors can filter without undue ripple. The effect shows itself as dark bars on the picture, and is most noticeable at low video levels.

The modifications listed below will overcome this problem, as well as prolonging lamp life:

- Insert a 22 ohm resistor in series with each lamp.
- Increase transformer secondary voltage from 12.6V to 15V.
- Connect the shunt regulator shown below in the supply line to the controlled amplifiers.



The transistor types used in the prototype have been tested and give good performance. However, the type numbers listed should not be regarded as binding, and the interested constructor is invited to experiment. The original transistors are VHF types with a fairly low gain and a high Ft. Bias conditions may need to be changed to suit substitutes of different gain to the originals.

In addition to the above listed modifications, some further notes on operation may be helpful:

- In some instances it will be found impossible to set up a channel by using the bias control, due to excessive DC level at the input. This condition may be corrected either by modifying the source, or by using an isolating capacitor.
- Depress only one preview button at a time, otherwise double termination will occur. For the same reason, do not terminate the preview monitor into 75 ohms.
- Keep the cable run to the preview monitor as short as possible.

Note that the last two listed limitations are due to the simple nature of the preview circuit, and should not interfere unduly with normal operation.

Finally, it must be emphasised that this project is intended for experienced constructors possessing the necessary ancillary equipment.

Circuit & Design Ideas

Conducted by Ian Pogson

Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Your contributions are welcome, and will be paid for if used.

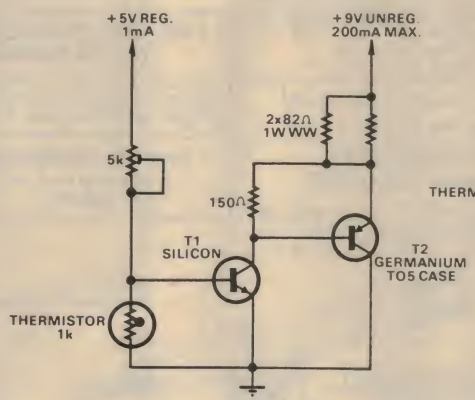
Economical crystal oven

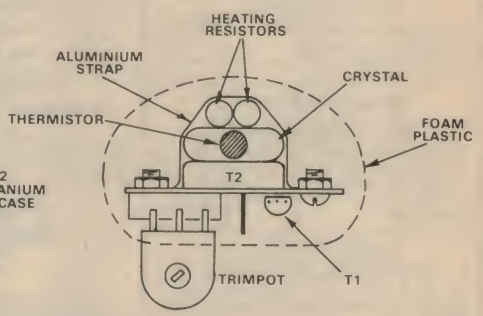
This refinement may be added to existing equipment, such as a frequency counter which uses a crystal oscillator as a reference frequency. It provides proportional rather than on-off control. All the components are readily available and are mounted on the crystal, leading to high efficiency and low power consumption.

All heat produced (2 watts maximum) is utilised in maintaining the crystal temperature. All the oven components except the trimpot operate at the crystal temperature. The crystal socket and a simple tie around the foam insulation are sufficient support.

The thermistor which I used is about 1k at room temperature. Values much different from this may require circuit changes. For correct operation the current through the thermistor (e.g. 1mA) should be much more than the base current of transistor T1 (e.g. 0.1mA). T1 and T2 should have low leakage currents. If T2 is a silicon type, increase the 150 ohm resistor to 680 ohms.

The supply voltages may be available in the existing equipment power supply.





The maximum drain is only 200mA. An unregulated voltage higher than 9V would require higher value heating resistors. The power transistor T2 supplies some of the heat when the operating temperature is reached and proportional occurs. Temperature stability is dependent on the 5V supply and the efficiency of the foam insulation. Some heat unavoidably leaks away through the crystal socket.

The oven should operate a little above the maximum temperature expected inside the equipment, which should be well ventilated. Set the trimpot so the current drawn from the unregulated supply is about 30mA, with the equipment at maximum temperature. My unit reaches operating temperature in 5 to 10 minutes, depending on the ambient temperature.

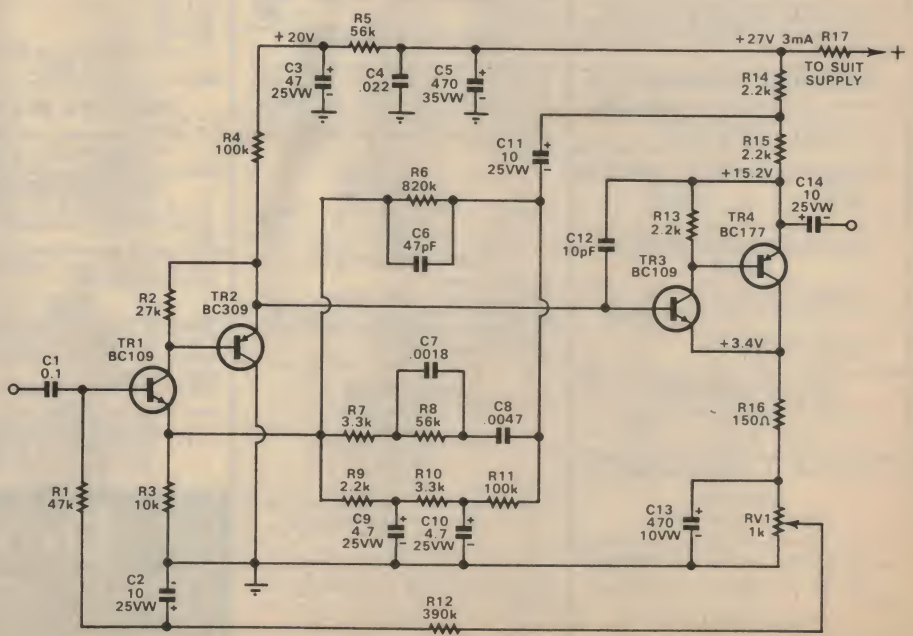
(By Mr. P. H. Mathieson, M.I.E. Aust., S.I.L. Box 115, Kathmandu, Nepal.)

Preamplifier for magnetic pickup

This preamplifier circuit is formulated around a two transistor configuration which came to my attention in "Wireless World" for January, March and June, 1972.

Voltage gains of up to 66dB are obtainable and two such stages are capable of over 100dB gain. The gain of the second stage is reduced to about 30 by negative feedback. This feedback raises the input impedance of TR3 to achieve maximum gain from the first stage. TR1 is operated at a collector current of about 20uA. Approximately 52dB of negative feedback at 1kHz is applied from the junction of the emitter load resistors (R14, R15) to the emitter of TR1 via the RIAA compensation network (R6, R7, R8, C6, C7, C8) reducing the closed loop gain to 80–2mV in for 160mV out. Under these conditions the preamp is capable of delivering 5V RMS into a 22k load, from 20Hz to 100kHz.

Maximum output at 1kHz into a 22k load is 7.6V, requiring 95mV at the input



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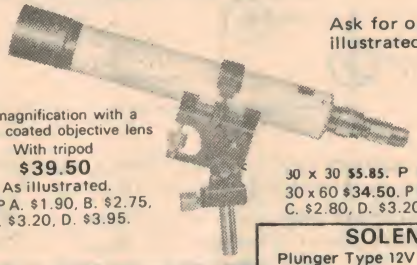

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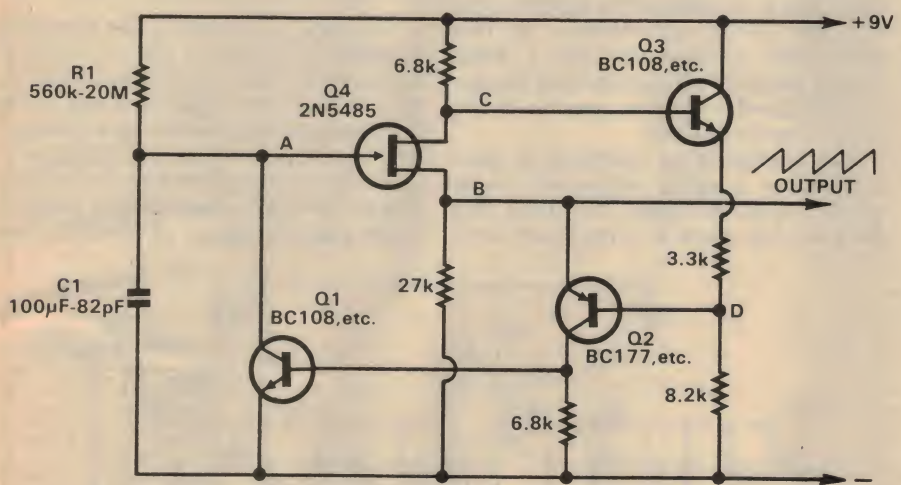
before clipping. Total noise and distortion at 1kHz and 20kHz was measured as .04% and 0.2% respectively, at 1V output. The same readings were obtained directly from the audio generator. Noise output measured at 77dB below a 5mV input signal with a magnetic cartridge loading the input. The RIAA curve is followed within 1dB, modified at the low frequency end by the rumble filter network (R10, R11, C9, C10 and C1). The rumble filter may be dispensed with by deleting R10, R11 and C10, by increasing C9 to 10uF and C1 to 0.47uF.

The input impedance is set by R1. This resistor can be increased to 4.7M with suitable readjustment of the bias preset pot, if a higher impedance is required for other purposes. The 1k pot allows for a precise setting of the bias point providing one has access to a CRO. The pot may be replaced with fixed resistors (R18, R19) of 680 ohms and 330 ohms, returning R12 to the junction of these resistors. R17 is chosen to suit the supply voltage, 3mA being drawn with Vcc equal to 27V.

Two preamplifiers may be built on Veroboard, in a mirror image fashion and mounted back to back with a metal shield plate between them, making for much better channel separation. Although the use of four transistors per preamplifier may appear to be superfluous compared with more usual two transistor circuits, it only requires the addition of two transistors and two resistors.

(By Mr W. L. Roberts, 20 Boronia Street, South Granville, NSW 2142.)

Sawtooth oscillator



This is a relatively simple sawtooth oscillator with a very good waveform, which may be used as a timer or a timebase for an oscilloscope. The highest frequency tested was about 500kHz and the longest time tested with R1 at 20M and C1 at 100uF was found to be 15 minutes.

The action is as follows. Q1 and Q2 are initially off. C1 charges through R1 and voltages at points A and B rise, while voltages at points C and D fall. When the voltage at point B is about 0.4V above point D, Q2 switches on and thus triggers Q1, discharging C1.

Component values are not critical. The only point to watch is that the FET does not saturate with too high a drain resistor load or too low a source resistor value.

(By Mr B. Morris, 57 Kangaloon Street, Jindalee, Qld 4074.)

Adjustable bipolar level with one reference

There are situations where a signal requires the addition of a DC level of either polarity. The standard procedure is to string a potentiometer across the positive and negative supply rails. The wiper output is either added to the signal directly or through an op amp buffer. The preceding scheme has an inherent weakness due to the dependence on the stability of both supplies (or reference elements such as zeners). Any drift of either supply is reflected at the output. The proposed scheme eases the constraint on the stability of the second supply and eliminates one reference element (if used). From the diagram

Vout =

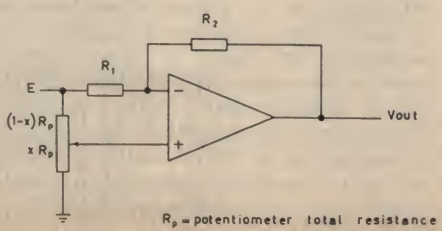
$$\left[\frac{R_1 + R_2}{R_1}\right] \cdot \left[x - \frac{R_2}{R_1 + R_2}\right] \cdot E$$

where E can be the voltage of any of the supply rails or any other stable voltage (zener).

If $R_1 = R_2$ then Vout = $(2x - 1)E$ and $-E \leqslant Vout \leqslant E$ for $0 \leqslant x \leqslant 1$.

The op amp acts as an inverter or follower depending on the wiper position, and Vout assumes a value linearly related to the corresponding fraction "x". The value of R_P does not appear in the result but can be chosen to be twice R_1 for minimum drift at near-zero output voltages.

(By A. Bendali, National Measurement Laboratory, CSIRO, University Grounds, City Road, Chippendale, NSW 2008.)



What's new in Solid State

CMOS gates and FM front-end ICs

There's no doubt about it, the CMOS logic family is growing fast. Hardly a week seems to go by nowadays without an announcement of further devices by one or more of the manufacturers. At the moment the all-up total seems to be at around 160 different devices, with about 106 of these in the RCA-originated "4000" family and the rest in the "74C" family.

National Semiconductor has just announced a couple of interesting new CMOS devices, one an addition to their 74C range, and the other a line driver which combines CMOS with bipolar technology.

The first device is the MM74C14, which is a "hex Schmitt Trigger"—ie, six Schmitt trigger elements in a single package. The elements have a hysteresis which varies from 2.2V at 5V supply to 5V with a 15V supply, with a very low temperature coefficient—typically 0.5mV/degree C at 10V supply. This together with a noise immunity of 70% of the supply voltage makes them easy to work with. One useful application of the Schmitt elements is in low power oscillators—a single element can become an oscillator by adding only one resistor and capacitor.

A special version of the hex Schmitt device known as the MM74C914 is provided with a special input protection scheme that allows the input voltage levels to exceed the supply or ground level by up to 25 volts.

The line driver device is called the MM88C29, and provides four line driver elements each having a bipolar pull-up transistor in the output stage. The device operates over a supply range of from 3 to 15V and has a noise immunity of 45% of the supply voltage. The drivers are capable of sourcing typically 80mA, and have an ON resistance of 20 ohms.

Similar performance is provided by a related device, the MM88C30, which has two four input-differential output line driver elements. Each element may be used to perform either the AND or NAND function in positive logic depending upon which output is used. Apart from driving balanced data lines, the applications include lamp drivers, relay drivers, and clock line drivers.

Further information on these new CMOS devices is available from NS Electronics Pty Ltd, cnr Stud Road and Mountain Highway, Bayswater, Victoria.

In the June issue, you may recall that we gave brief details of a new FM front-end IC announced by Signetics: the SD6000. Further information on this device has just arrived from J. Brian Dance, in the UK. So I am turning the rest of this month's column over to Brian, who writes as follows:

The availability of complete IF subsystems as a single integrated circuit (such as the CA3089, TDA1200 and NE563) has greatly simplified VHF receiver circuitry, but until recently discrete devices have always been used in the front-end. However, the Signetics SD6000 is an IC which has been specially developed for use in VHF front-ends at about 100MHz. It is encapsulated in a normal 8 pin dual-in-line plastic case and is very economical.

The internal connections of the SD6000 are shown in Fig. 1. The device contains two dual gate MOSFETs which are used as the RF stage and mixer. Each of the four gates in the SD6000 is protected by a zener diode which will bypass to the substrate any static or other voltages which are more positive than +25V or more negative than −0.3V. No special precautions are therefore required when handling the SD6000. It may be soldered directly into circuits, although an earthed soldering iron should be employed.

The two MOSFET devices in the SD6000 are n-channel enhancement devices made by the special Signetics D-MOS technique, which enables accurately controlled channel lengths of the order of 1 micron to be fabricated. The two devices are positioned in the case so that coupling between them is minimised. This assists stability and reduces unwanted radiation of the oscillator signal from the aerial.

The dual gate devices used in the SD6000 provide a very high gain and an excellent noise figure. In addition, they have very linear characteristics and this minimises cross modulation. The feedback capacitance is of the order of 0.03pF. Care must be taken to ensure that the maximum permissible drain current of 50mA is not exceeded.

A typical front-end circuit using the SD6000 is shown in Fig. 2. Variable capacitor tuning is employed in this circuit, but varactor (Varicap) diode tuning has also been employed with this device. The circuit shown provides a frequency coverage of about 88MHz to 108MHz. The power gain is about 30dB at 100MHz, whilst the noise figure of 2.5dB (typical) is excellent. (The maximum noise figure from any SD6000 at 100MHz is 3dB.)

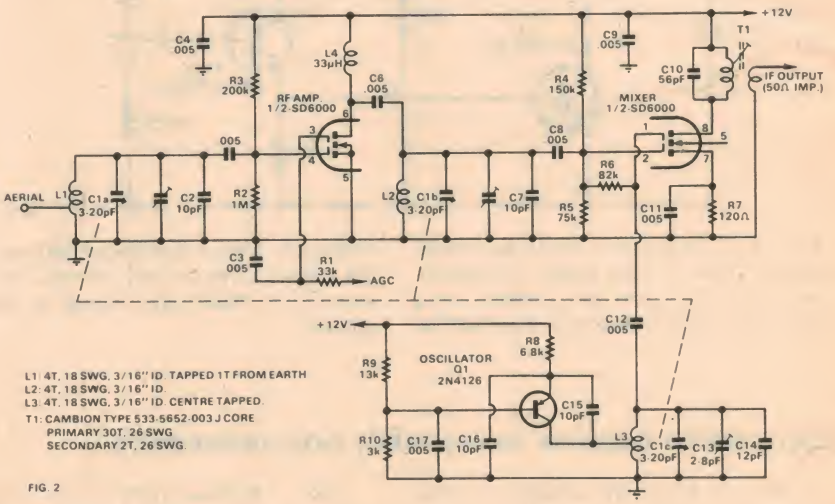


FIG. 2

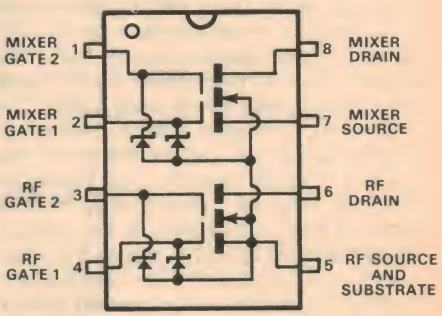


FIG. 1

The signal from the aerial passes through the tuning circuit containing L1 to gate 1 (pin 4) of the SD6000. AGC is applied to gate 2 (pin 3) of the RF stage, the AGC control range of 50dB being

very wide. The change of gain with the gate 2 voltage is shown in Fig. 3 for the case where the gate 1 bias is +10V.

The amplified output from pin 6 of the RF stage is fed through the tuned circuit containing L2 to gate 1 (pin 2) of the mixer stage. The oscillator employs a 2N4126 or similar transistor, the oscillator output passing through C12 to gate 2 (pin 1) of the mixer unit.

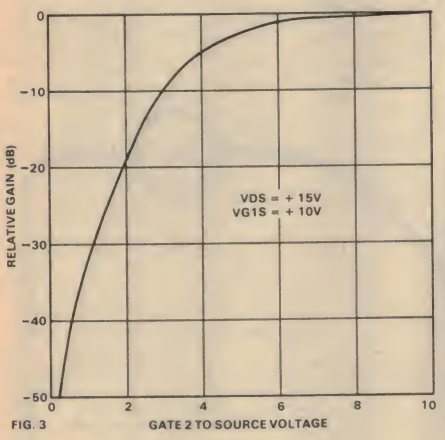


FIG. 3

This type of circuit provides extremely high isolation between the local oscillator and the input circuits, since a separate gate is available for the oscillator voltage and the stray capacities can be kept very small. The oscillator stability is of the order of 40kHz per volt change of the power supply voltage and about +10kHz per °C change in temperature.

The SD6000 provides a first class performance. It should enable FM front-ends to be made which are very economical and yet which provide a somewhat better performance than earlier front-ends. Enquiries regarding the device should be directed to the local agents for Signetics, who are Tecnico Electronics, at 53 Carrington Road, Marrickville, NSW, 2204.

For further data on devices mentioned above, write on company letterhead to the firms or agents quoted. But devices should be obtained or ordered through your usual parts stockist.

Practical electronics demonstration:

OHM'S LAW

by A. J. LOWE

This month's teach yourself board provides an understanding of the most fundamental law in electronics and electrical engineering—Ohm's law. The board was constructed to the standards described in earlier articles. The arrangement of components is illustrated in Fig. 1 with the very simple circuit shown in Fig. 2.

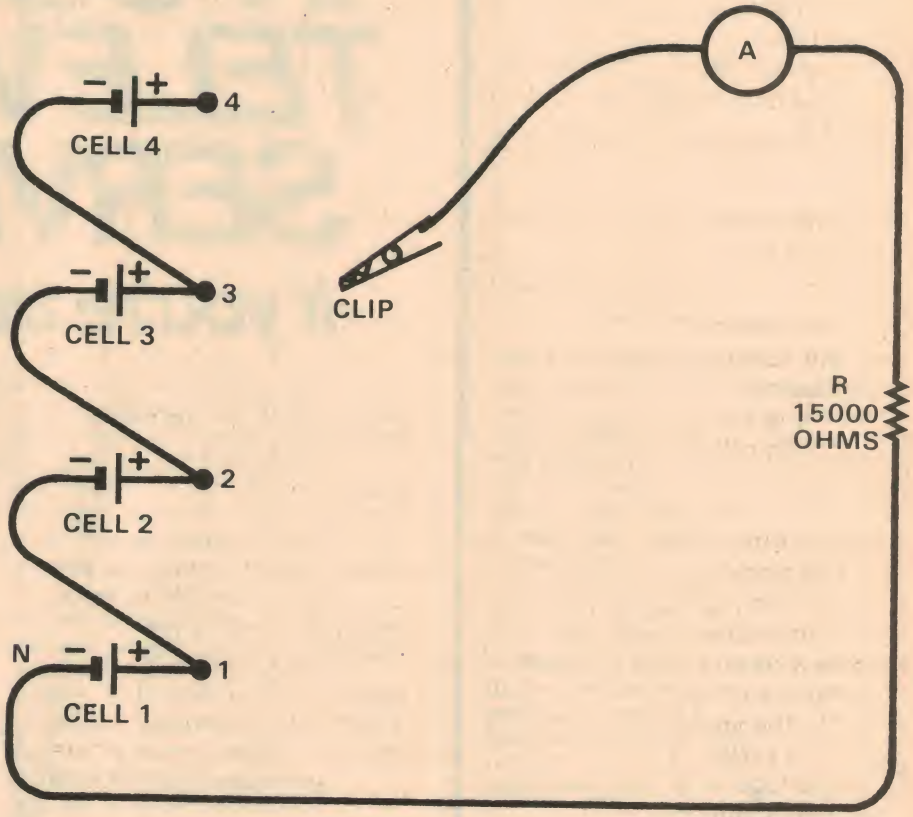
The four AA cells used were well separated so that the series connections between them could be easily seen and understood.

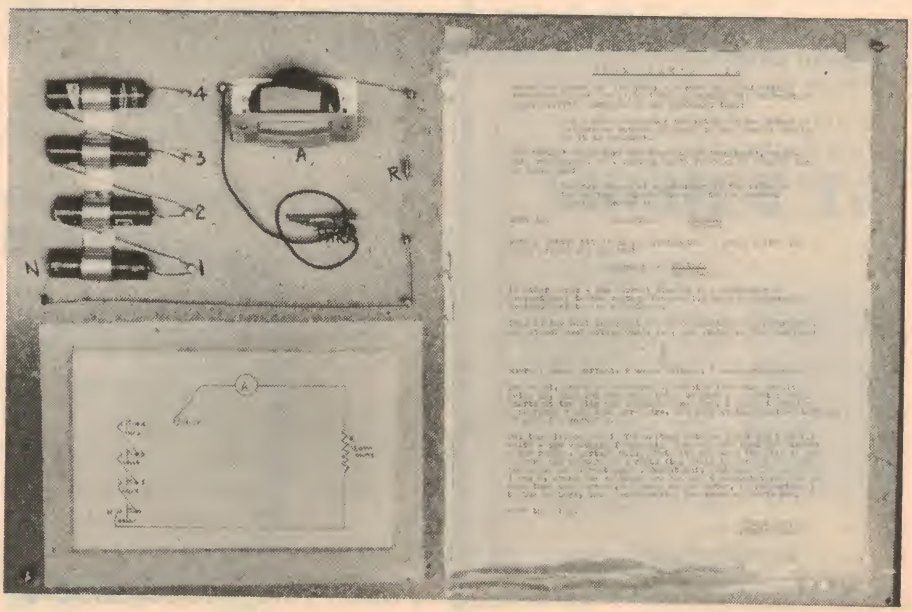
The meter used was an edge reading meter from a tape recorder which was available and workable after a small repair had been completed. However any small meter could be used—after removing any shunt or series resistor which it contained.

The resistor R is of a value selected so that the meter reads rather less than full scale when it is connected in series with the resistor and all four cells. In the prototype a resistor of 1500 ohms served the purpose, but for a meter of lower sensitivity a smaller resistor would be required.

The scale of the meter was covered with white "Contact" and then "recalibrated" by marking a "1", "2", "3" and "4" at the positions of the pointer when 1, 2, 3 or 4 cells are connected respectively. Purists may be horrified by this approach, as it assumes the truth of something one is purporting to demonstrate. Never mind, we are not trying to verify Ohm's law—merely to demonstrate it. The purists can buy an accurately calibrated meter if they so desire. The method adopted was much cheaper.

After marking, the meter was mounted on a sloping aluminium panel labelled "Current". No units—milliamps or amps—are indicated.





PARTS LIST

4 AA cells
1 small meter—see text
1 resistor to suit meter
1 clip, wire nails, aluminium

KNOW OHM'S LAW

About 150 years ago (in 1826) a German physicist, Herr Georg Simon Ohm (1787-1854), summarised his observations about electric currents in the statement that:—

For a given conductor the ratio of the potential difference between its ends to the current flowing in it is constant.

The "ratio" which Herr Ohm found to be "constant" we now call resistance and, stating Ohm's findings in simpler terms, we could say:

The resistance of a conductor is the ratio of the voltage between its ends to the current flowing through it.

That is: $$\text{Resistance} = \frac{\text{Voltage}}{\text{Current}}$$

With a little simple arithmetic we could switch the words around and say that: $$\text{Current} = \frac{\text{Voltage}}{\text{Resistance}}$$

In other words—the current flowing in a conductor is proportional to the voltage between its ends and inversely proportional to its resistance.

This is the most important and basic equation in electricity. It has been called Ohm's law, and stated as the equation:

$$I = \frac{E}{R}$$

Where I means current; E means voltage; R means resistance.

The model, which is connected up exactly like the circuit below it, will let you check this. We have a conductor which starts at the clip and includes some wire, a current meter A, a resistor R, more wire, and ends at the negative terminal of cell 1—marked N.

Put the clip on pin 1. The voltage between pin 1 and N is 1.5 volts—the voltage of one cell. You will see that the current meter reads a certain value. Note it. Now move the clip to pin 2 where the voltage is 3 volts (two cells in series) and note the value of current again.

Repeat this with the clip on pins 3 and 4, where the voltages are 4.5 and 6 respectively. Note that the current, as shown by the meter, IS proportional to the voltage, thus demonstrating the truth of Ohm's law.

Park the clip.

The unit of resistance—the OHM, is named after Herr Ohm, and a conductor has a resistance of 1 ohm if a voltage of 1 between its ends produces in it a current of 1 ampere.

Learn to use Ohm's law— and think of it as the equation:

$$I = \frac{E}{R}$$

Where I is the current in amperes
E is the votage in volts
and R is the resistance in ohms.

Simple arithmetic shows that: $R = \frac{E}{I}$ and $E = I \times R$.

The third version—$E = I \times R$—is very useful because it enables you to work out the voltage drop across a resistor of known value when you know the current through it.

Letters to the editor

The views expressed by correspondents are their own and are not necessarily endorsed by the editorial staff of "Electronics Australia". The Editor reserves the right to select letters on the basis of their potential interest to readers and to abbreviate their contents where this appears to be appropriate.

Amateur regulations

Thank you for extending me the opportunity for replying to your letter which appears in the June issue of Electronics Australia. The Department recognises that any set of regulations should reflect current thinking on the operation of the particular facility or service and, of course, the Handbook for Operators of Radio Stations in the Amateur Service is no exception to the rule.

The regulations presently contained in the Handbook have been under review for some time and in order to achieve documents which more accurately reflect the present trends, representatives of the Wireless Institute of Australia are participating in the review. It is my wish that the work be completed at the earliest opportunity; I am sure you will appreciate, however, that the modifications necessary to provide for Novice licensees will lead to some further unavoidable delay in its completion.

Turning now to your letter, the Department is unable to agree with the hypothesis that

"provided the transmissions are not interfering with other services and are identified at regular intervals, it could well be argued that the remaining content is of no interest or concern to anyone other than the amateurs concerned."

Australia, in common with many other Administrations, considers it in the national interest to minimize erosion of revenue of publicly owned telecommunications systems. One of the ways in which this is achieved is by limiting the content of transmissions between amateur stations to:

"Messages of a technical nature relating to experiments being conducted by the stations concerned and to remarks of a personal character for which, by reason of their unimportance, recourse to the public telecommunication service is not justified".

The fact that similar words appear in Article 41 of the International Radio Regulations shows that the content of amateur transmissions is of concern not only nationally but also internationally.

As Australia is a signatory to the International Telecommunications Convention and to the Radio Regulations annexed thereto, we are obliged to ensure that Australian amateurs comply with the International requirements and to this end our monitoring stations regularly monitor these transmissions. Obviously the cost of attempting to monitor the total contents of all amateur transmissions would be prohibitive and for this reason Australia, and most other countries, monitor on a sampling basis only.

Your letter mentioned five specific points; the headings are set out below together with our comments:

(1) No provision for pulse code modulation (PCM) and

(2) Restriction of RTTY and FSK signals to 5-unit code:
Although the Department is in regular communication with representatives of the amateur service, it has not received any request for authorisation of Pulse Code Modulation or more sophisticated machine telegraphy systems. If such a request was received, it would be treated sympathetically.

(3) Restriction of TV Signals to pure "vision only":
The position which exists at present is that any appropriate type of modulation indicated in Paragraph 59 of the Handbook may be used for a sound transmission which accompanies the transmission of television images by an amateur station. In accordance with Paragraph 66 the sound transmission must be in a band above 144MHz.
As indicated above in relation to PCM, the Department has not been asked to approve use of "sound in syncs" or the other forms of modulation mentioned in your letter. It would, of course, be prepared to consider any such request should an approach be made.

(4) No Morse Transmissions by Restricted Licensees:
The free radiation of morse telegraphy signals by operators who have not reached a minimum standard of proficiency is undesirable for a number of reasons including their inability to correctly identify their transmissions. The Novice Licence will allow operators to commence transmissions with a lower demonstrated standard of telegraphy than has been the case in the past. Novices will then have the opportunity to further develop their telegraphy skills under practical operating conditions.

(5) Total prohibition on music, all bands:
Your letter correctly interprets the reason why transmissions of music by amateur stations is not authorised. It tends to overlook however that similar restrictions apply equally to all radio services which are not classified as broadcasting. The Department feels that the use of music is not necessary for the development of modulation systems and that such development should be, whenever possible, "off-air". This is in line with paragraph 700 of the International Radio Regulations, which reads:
"Before authorising tests and experiments in any station, each administration, in order to avoid harmful interference, shall prescribe the taking of all possible precautions such as the choice of frequency and of time and the reduction or, in all cases where this is possible, the suppression of radiation. Any harmful interference resulting from tests and experiments shall be eliminated with the least possible delay".

In conclusion I hope that the foregoing will help to clarify the points which you have raised.

H. S. Young, Assistant Secretary
(Regulatory and licensing)
Radio Frequency Management Division
Postmaster-General's Department
Melbourne

Transistor & diode offer

The response to the transistor and diode offer we made in your September issue was beyond all expectations. The 20,000 transistors we had set aside for the offer were completely gone only a day and a half after the issue was published. After a frantic search we managed to get another 15,000 in short order, but these too went after another day!

Luckily we had 160,000 diodes, so that even though about 30,000 of these have also gone in the first four days, we are in no danger of running out.

As I write this letter we are currently negotiating for a further 100,000 transistors so that the enormous number of mail orders won't be disappointed. However we are absolutely swamped with orders, and our normal same-day service has fallen somewhat behind despite all our efforts and considerable staff overtime.

Incidentally, there were some orders for as many as 50 packets, or 1,000 transistors at a time. The mind boggles!

There may be delays in supplying some of the readers with their offer transistors. But we're doing our best to ensure that no one will be disappointed.

Dick Smith, Managing Director
Dick Smith Electronics Pty Ltd
Gore Hill, NSW

Classical Recordings

Reviewed by Julian Russell

Schumann—Piano Concerto in A Minor

SCHUMANN – Piano Concerto in A Minor. Konzertstuck in G for Piano and Orchestra. Wilhelm Kempff and the Bavarian Radio Symphony Orchestra conducted by Rafael Kubelik. DGG Stereo 2530 484.

This recording is not for those looking for a prettified, dainty performance of a composition often given these characteristics. True, clarity and elegance are necessary for its successful delivery and you will find no lack of them in this reading. But the approach of both the soloist and conductor can best be described as sterner than that usually awarded this delightful concerto. I use stern in the sense that might describe an otherwise kindly parent. And this effect is achieved, despite plenty of changes of sonorities in the piano tone—admirably engineered, by the way—Kempff alternately caressing and asserting the sound. His sometimes squarish phrasing is interrupted by an unexpected rubato. Kubelik is far too good a conductor not to follow closely his soloist's many changes of mood so that the general effect on me was that neither enjoyed what they were doing very much.

This might be explained by the fact that, since boyhood, I have always thought of the work in lighter, brighter, even happier terms. (I first heard it when very young played by Cortot, a performance that so completely charmed me that I must have set it for a standard ever since.) Yet in the recording under review, the romantic sections couldn't be more romantic and the vigorous parts more energetic.

Even so, while I found myself admiring Kempff's reading, I must confess that I didn't enjoy it as much as I had hoped. There is no questioning his splendid control—and that of the orchestra under Kubelik, usually a very romantic fellow indeed as his playing of Mahler shows. But somehow they seem to be seeking something deeper than I have ever suspected of lurking in this work, which, by the way, is one of my favourite concertos.

I realise that this purely subjective reaction may differ very much from that of others so please don't be put off from acquiring it without first giving it a trial, especially as the general production is of a very high standard. Moreover on the second side there is a splendid performance of Schumann's Konzertstuck for piano and orchestra in G—not to be confused with the piece of the same name by Weber—that gave me very great satisfaction indeed. In this you will find much less of the occasional stiffness and weight that worried me so much in the concerto.

I wouldn't like to question the validity of the performance of this latter, but it didn't enchant me as it so often has done in other hands.

★ ★ ★

VERDI—Il Trovatore. Complete opera. Zinka Milanov (Leonora); Jussi Bjoerling (Manrico); Leonard Warren (Count di Luna); Fedora Barbieri (Azucena); Nicolo Moscona (Ferrando) and others with the Robert Shaw Chorale and the RCA Orchestra conducted by Renato Cellini. RCA Mono AVM2-0699. (Two discs.)

This mono re-issue delves deep into the past. It was recorded with an impressive cast in New York in May 1952. Indeed it is advertised on the box as the first high fidelity recording of the opera. Although it was released in the US I can find no trace of its having been issued in the UK. Perhaps in those days copyright had something to do with it though here another puzzle pops up. The copyright date is 1970. The quality of the sound suggests reprocessing; at any rate it would not disgrace any contemporary company and under the Victrola label it is economy priced.

Speaking of the sound, I would go as far as to say that the balance between orchestra and singers is ideal for this type of Italian opera, or perhaps more specifically for this Verdi period.

I preferred the men's voices to the women's. Leonard Warren is at the top of his form as the Count di Luna. His voice has an attractive silky quality that can swiftly assume dramatic urgency. Very occasionally he shows signs of straining but, all round, his is a more than satisfactory performance. Matching him in bel canto production is Jussi Bjoerling using his mellifluous voice with unswerving good taste and apparent ease. The Ferrando (Nicolo Moscona) has a pleasant light bass. I would have classed him as a bass baritone rather than a bass, as is done on the cast list.

Zinka Milanov is a good if not inspired Leonora. Her voice often thins a little at the top of the range. Reliable is perhaps the best word to describe her performance. Her companion Inez (Margaret Roggero) is not impressive.

As Azucena, Fedora Barbieri starts with a wide wobble reminiscent of Eastern European women singers. But she soon improves and is nothing if not forceful in a role that calls for melodramatic treatment. But then the whole opera is one that calls for performance with all stops out. The chorus is expressive and well drilled and the anvils in the Gipsy Camp scene used discreetly enough to avoid vulgarity. The RCA Orchestra is also disciplined but sensitive under Renato Cellini.

Surprising as it might seem this set has worn so well that I find it difficult to think of an all-round better. For that reason I recommend it strongly.

★ ★ ★

FALLA – La Vida Breva. Complete Opera. Victoria de los Angeles (Salud); Ines Rivadeneyra (The Grandmother); Carlos Cossutta (Paco) and others with the Orfeon Donostiarra Chorus and the National Orchestra of Spain conducted by Rafael Fruhbeck de Burgos.

GRANADOS – Collection of Tonadillos sung by Victoria de los Angeles accompanied by pianist Gonzalo Soriano. World Record Club Stereo S/4531-2.

This set in now nearly 10 years old and none the worse for that reason. The engineering is good and, in those days, Victoria de los Angeles was at her very lovely best—so that you will have no worries on that score. I can think of no one better suited to the role except perhaps in the old days, Conchita Supervia, and I am not even sure if she ever sang it before her early tragic death in childbirth. The Grandmother, Ines Rivadeneyra, has that rich canto honda edge to her voice that I always find so attractive in Spanish music. In their moments of rapture tenor Carlos Cossutta is sometimes overwhelmed by de los Angeles but all round he makes an excellent fist of the role. He is one of those tenors with a baritone-like quality in the low register though he deals well with the high notes, too. The rest of the cast are richly idiomatic in their parts.

The chorus, which has an important role in the little opera, does extremely well. The performance under Rafael

For information on World Record Club albums, contact the Club at 605 Camberwell Rd., Hartwell, Vic., 3124. Tel. 29 3636.

Fruhbeck de Burgos—who is Spanish born despite his name—brings off just the right atmosphere. Everything sounds very genuine and picturesque. In it you will recognise many tunes, some of them heard here with chorus, something that seldom happens when they are performed in a concert hall. But all these merits cannot disguise the thinness of the libretto. Indeed for many years the opera has been called a Cavalleria Rusticano without the blood. And without the Mascagni's street organ tunes, happily! I found it all both beguiling and exciting.

The fourth side is taken up with a collection of tonadillos by Granados sung by de Los Angeles with that splendid pianist, Gonzalo Soriano as her accompanist. Tonadillos have a long history in Spanish music but nowadays the word usually means a love song. Here they are very brief, all of them unmistakably Spanish in form and content. There are nine of them in all, a real novelty that is in every way charming, performed as they are with beautiful accuracy by singer and accompanist. I found them an enchanting experience. This is another set I can recommend enthusiastically.

★ ★ ★

MONTEVERDI—Selva Morale e Spirituale and the Religious Music for St. Mark's, Venice. The Lausanne Vocal and Instrumental Ensemble under the direction of Michele Corboz. World Record Club Stereo S/6360-7. (8 Discs.)

I didn't realise what I was letting myself in for when I accepted this massive set to review. I always listen to Monteverdi's madrigals and dramatic works with both enjoyment and wonder—wonder at the high level of the composer's inspiration and originality. But only rarely on this 8-disc set of church music composed between 1615 and 1651 does he offer the enjoyment of his secular music. Admittedly the set records a towering enterprise which I am more than happy to have, but it will appeal to music scholars rather than the general run of music lovers. But even Monteverdi's most enthusiastic admirer will, I think, find that playing the whole set at one or even two sittings is a stern exercise in self-discipline. The task is made easier because of the copious accompanying notes in English and the English/Latin texts.

In all there are 71 separate items and I have not the necessary scholarship of the music of the period to be able to comment on the authenticity of style of their presentation here. I can only judge them musically, and on that level one is again filled with wonder at the vast industry, not always supported by inspiration, that went into their creation. And I think I should point out that during this period Monteverdi was also writing the peerless music that can still excite and charm.

MOZART—String Quintets No. 1 in B Flat; No. 2 in C; No. 3 in G Minor; No. 4 in C Minor; No. 5 in D; and No. 6 in E Flat. Played by Arthur Grumiaux (violin), Arpad Gerecz (violin), Georges Janzer (viola), Max Lesueur (viola) and Eva Czako (cello). Philips Stereo 6747 107. (Three discs in box.)

I have no reservations at all about this superb set of Mozart's complete string quintets. To me everything here is perfection—tone, phrasing and ensemble. The sound is brilliant, so brilliant indeed that I found it necessary on my equipment to cut the highs a trifle for maximum enjoyment. It is one of the most consistently seraphic sets that I have heard for a very long time. As to the music itself I can do no better than quote the sleeve notes by the eminent musical scholar and critic, Deryck Cooke, who finishes them with these words: "The annotator can only despair of describing such music in words, and in any case it speaks for itself with the utmost clarity and eloquence.

"One thing, perhaps, may be pointed out: in the Minuet and Finale of K. 614—his last important chamber work—Mozart turned back once more to the style of Haydn which he had so completely outgrown in his mature chamber music; and thereby he paid his last tribute to the man who had inspired, loved and helped him like a second father." To that, I fear, I can add nothing except the strongest possible recommendation for every Mozart lover to beg, borrow, buy or if necessary steal a set as soon as possible. There is a lifetime of enjoyment here.

Guide to a basic record library

RECORD CHOICE by MARTIN GOFF. (Cassell).

The book publishers Cassell have sent me a review copy of their paperback Record Choice, a Guide to a Basic Classical Record Collection, by Martyn Goff. Goff has owned a record shop in London for over 20 years and has chosen a very carefully and sensibly compiled list of good examples of what new collectors might be looking for in the way of classical recordings. Of course, everybody will not find themselves always in complete agreement with all his choices, particularly as new issues are coming on to the market all the time and some of those recommended in his book might be deleted at any time. But it is, taken all round, an excellent aid to new collectors and, more importantly, might well remove the burden of correspondence from critics who are continually being asked the questions answered in it, questions which could often take days to reply to conscientiously. It should be available in all bookshops, especially those specialising in the sale of paperbacks.

Lighter Side

Reviews of other recordings

Devotional Records

BACK HOME WITH JOHN PETERSON. Orchestra and chorus conducted by Dick Bolks. Stereo, Singcord ZLP-925S. (From S. John Bacon, 12-13 Windsor Ave, Mount Waverley, Vic 3148.)

John Peterson is one of the most prolific and best known of the contemporary composers of evangelical music in the USA. The hymns in this album have been published in Singspiration songbooks, and all appear in the "The Country Western Choir No. 2". The titles: He's The One—Wings Of Prayer—Surely Goodness And Mercy—Show A Little Love And Kindness—Chariot Of The Clouds—I've A Home Beyond The River—Lead Me—Heaven Came Down—Spend A Little Time With Jesus In Prayer—Over The Sunset Mountains.

The reference to a country western hymnal and western style songs on the jacket could be misleading. It's a very "civilised" west, gently rhythmical, pleasantly musical, with never a blade of bluegrass in sight. If you know any one of the numbers—say "Heaven Came Down" or "Sunset Mountains"—they're all like that.

The sound is smooth and the surface quiet. (W.N.W.)

★ ★ ★

THE BBC PRESENTS SONGS OF PRAISE. Various Choirs. Stereo, BBC Records REC-141S (Distributed by Phonogram).

A popular and long-running series on BBC television is the program "Songs of Praise", initiated in 1961 and commanding a greater audience than any other BBC religious program. The formula is simple: familiar hymns sung by choirs and congregations in typical English churches.

While most of this program was recorded in 1972 in St. Andrew's Church, The Westlands, Newcastle-on-Tyne, it is typical of the content in a "Songs of Praise" telecast. Present for the occasion were the Bedford Singers, The Dalaien Singers, two school choirs, plus local choirs and congregation.

Side 1 "Chiefly about the Christian and his God" has nine tracks: O Praise Ye The Lord—Just As I Am—Fisherman Peter—Jesus Good Above All Other—Lift High The Cross—Love Divine—Jacob's Ladder—Susanni—Thou Whose Almighty Word.

On side 2 "Chiefly about the Christian life in this world" is: Soldiers Of Christ Arise—Where Cross The Crowded Ways Of Life—By And By—Father Of Mercies In Thy Word—God My Father, Loving Me—Through The Night Of Doubt And Sorrow—Come All You Christian Gentlemen—Glory To Thee My God, This Night—Now Thank We All Our God.

The singing is typical of well disciplined choirs and congregations intent on praise of God and those who may want to share such an occasion will find very good value in the 18 tracks. Technically, the quality is average—adequate for ordinary listening but with enough "edge" in some tracks to disqualify it from the real hifi bracket. (W.N.W.)

★ ★ ★

FINALE. Richard and Patti Roberts, the World Action Singers, The Oral Roberts University Concert Choir and the Ralph Carmichael Orchestra. Stereo, Light LS-5629-LP. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals.)

Finale? The jacket notes explain that each of the ten numbers on this album was presented as the musical finale to an Oral Roberts prime-time television special. Arranged and conducted by the well known Gospel musician Ralph Carmichael, it goes, without saying, that the presentation is of a very high standard. It could be of interest to local groups, particularly as a complete vocal score is mentioned on the jacket.

Contrasting with the gently rhythmic John Peterson album reviewed elsewhere, this one has the modern big-sound approach appropriate to a TV special. The titles:

I'm Living In His Love—Pearl Of Great Price—Leaning On The Everlasting Arms—Miracle Of Faith—Great Is Thy Faithfulness—Joy Is The Centre Of His Will—Back To Love—Oh Great God—Amazing Grace—America The Beautiful/Battle Hymn Of The Republic.

Ambitious arrangements, ambitious presentation, modern but always tuneful . . . that's "Finale". Also an imported album, the quality is excellent. (W.N.W.)

★ ★ ★

ORGAN MUSIC from Albury Wesley Church. Graham Stocks at the Conn Organ. Stereo, Crest SCP 12-71. (From The Conn Organ Centre, 533 Saunders Ave, Albury 2640. $4.00, post free.)

Primarily, this album was intended as a memento of the centenary of the Albury Wesley Church, due to be celebrated next month. The organ featured is a Conn church model 632, installed in 1969 and carefully voiced to the requirements of the building. At the console is the church's own organist, local musician Graham Stocks, playing a program ranging from the familiar and lightly classical, to favourite hymns:

Jesu, Joy Of Man's Desiring (Bach)—Largo (Handel)—Priere Et Berceuse (Guilmant)—Trumpet Tune (Purcelli)—Evensong (Martin)—Solemn Melody (Davies)—I Love To Tell The Story (Fischer)—Recitative And Chorale (Baylor)—Echo (Bach)—Jesus Walked The Lonesome Valley (traditional)—Minuet From "Bernice" (Handel)—Now Thank We All Our God (Cruger)—Arioso (Bach)—Softly And Tenderly (Thompson).

Although the album is available locally from the church and other sources, Bruce Mitchell of the Conn Organ Centre sent me a review copy for possible wider attention—and with good reason: without appearing consciously to do so, Graham Stocks capably demonstrates the very musical voices of the Conn 632 and their suitability for the kind of music likely to be required in churches.

The bass in the recording is a little on the heavy side, the double-vibrato effects are a bit much on occasion for my liking and there are one or two minor recording faults but, for those interested in the music, the church or the instrument it will be good value. (W.N.W.)

Instrumental, Vocal and Humour.....

GREATEST HITS OF THE FORTIES. Arthur Fiedler and the Boston Pops. Vol 2 RCA Red Seal ARL 1-0507.

The Boston Pops give us another full throttle performance of twelve all-time favourites of the war years. Some of the titles included are: It's A Grand Night For Singing—Deep In The Heart Of Texas—Holiday For Strings—White Christmas—Tuxedo Junction—A String Of Pearls—Scarlet Ribbons—Warsaw Concerto—San Antonio Rose. The quality is good and it is a great record for stirring up an attack of the nostalgias. (N.J.M.)

Reviews in this section are by Neville Williams (W.N.W.), Harry Tyrer (H.A.T.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.) and David Edwards (D.W.E.).

SAXOPHONE MAGIC. Fausto Danieli, his saxophone and orchestra. Stereo, 2-record set, Disques Vogue (Festival). $7.95.

The ornate double-fold jacket leaves one in no doubt that the saxophone is the featured instrument in this brace of records and that the featured artist is Fausto Danieli. But that's as much as you'll learn from it, apart from the 24 track titles. Perhaps one should add that Disques Vogue recordings originate in Paris.

If you like the singing sax, gentle rhythm and the sort of sound that can so easily form a backdrop to a meal, then you'll like Fausto Danieli's program which includes numbers like:

Love Story—L'Arsene—Windmills Of Your Mind—Midnight—My Way—To Live, To Love—Raindrops Keep Falling—Everybody's Talkin'—El Condor Pasa—What Have They Done To My Song, Ma? . . . &c.

The sound is completely clean with not a whisp of distortion, hiss or surface noise. Good listening if you're partial to well-played singing sax. (W.N.W.)

★ ★ ★

THE RESTFUL MIND. Larry Coryell. Vanguard (Astor) VSD 79353.

Aided by Ralph Towner, Collin Walcott and Glen Moore, Larry has produced an excellent album of classical guitar playing. Featured titles are—Improvisation On Robert de Visee's Menuet II—Ann Arbor—Pavane For A Dead Princess—Improvisation On Robert de Visee's Sarabande—Song For Jim Webb—Julie La Belle—The Restful Mind.

Larry plays the Lo Prinzi acoustic guitar, which might mean something to those more "in the know", but only leaves me with the record to judge him by. Technically, the record is extremely good, with no perceptible surface noise, and no trace of edginess. I found that all tracks were pleasant on the ear, with "Improvisation On Robert de Visee's Sarabande" being the one I appreciated the most of all.

If you are fond of classical guitars, then this record must be too good to pass by, so be warned! (D.W.E.)

★ ★ ★

THE SVEN LIBAEK CONCERT ORCHESTRA. Festival L35419

This record could be regarded as a showcase for some of our best local musical talent, such as George Golla, John Sangster, Derek Fairbrass, to mention a few. There are twelve titles on the record: The Masterpiece—Song For Anna—You've Got A Friend—Aquarius—El Condor Pasa—Theme From "Shaft"—Theme From "Midnight Cowboy"—Mozart 40—Love Theme From "Airport"—The First Time Ever I Saw Your Face—Light My Fire.

The 'big orchestra sound' is well caught and the sound quality helps to make a really enjoyable record, either as a dining background or for the simple pleasure of just sitting and listening. (N.J.M.)

North of the border

GLEN DALY. Live from the Pavilion Theatre, Glasgow. Stereo, Astor GGS-1456.

Hoots mon—this is one of the happiest Scottish albums I have heard in many a long day. And not just happy; it's good as well!

Glen Daly is an entertainer in the steps of Sir Harry Lauder, Will Fyffe and others, with a very pleasant singing voice, and exactly the right accent to provide the spoken continuity between numbers. The album is, in fact, a generous recording of a concert before an enthusiastic audience in the Pavilion Theatre. The numbers:

Medley: I Belong To Glasgow, &c—Wedding Of Sandy Mac—Pal Of My Cradle Days—Medley: Broken Doll, &c—I Love A Lassie—Bonnie Wells O'Wearie—Medley: Put On Your Old Grey Bonnie—Paddy McGinty's Goat—Amazing Grace—Barefoot Days—Dear Little Boy Mine—Wee Deoch And Doris—Now Is The Hour.

Technically, the sound is absolutely clean and well balanced and the surface virtually flawless. If you enjoy this one half as much as I did, you'll have got your money's worth! (W.N.W.)

★ ★ ★

FIDGETY FEET. Bob Barnard's Jazz Band ATA L25187 Stereo Festival Release

This enjoyable record shows that jazz is alive and well in Australia. The personnel are Bob Barnard, trumpet; John McCarthy, clarinet & tenor sax; John Costello, trombone and vocals; Chris Taperell, piano; Wally Wickham, bass; Allen Geddes on drums.

The twelve tracks are: Fidgety Feet—Blues My Naughty Sweety—Play It Cool—Hindustan—Roses Of Picardy—Russian Lullaby — Riverboat Shuffle — Easter Parade—Smiles—Riverside Blues—First Up—When Johnny Comes Marching Home.

Recorded at ATA's Sydney studios, the quality is excellent. (N.J.M.)

★ ★ ★

BURT BACHARACH IN CONCERT A&M L35347 Stereo. Festival release.

I doubt if there is anyone that couldn't hum the tune of at least some of Burt Bacharach's well known hits and this disc should give you a good sample of his wares. With twenty-odd titles in mainly medley form it covers most of his best hits, including: Alfie—Walk On By—Raindrops Keep Falling On My Head—The Look Of Love—Anyone Who Had A Heart—Wives And Lovers—24 Hours From Tulsa—I'll Never Fall In Love Again—A House Is Not A Home—What The World Needs Now—Promises, Promises.

The quality is good and the concert atmosphere is well recreated. (N.J.M.)

★ ★ ★

TOM CAT. Tom Scott & The L.A. Express. Ode Records L-35,557.

Tom Scott, aided by Max Bennett, John Guerin, Robben Ford and Larry Nash, peddles a brand of music best described as a mixture of rock, pop, jazz and country. In addition to being influenced by such jazz greats as Gerry Mulligan, John Coltrane and Miles Davis, Tom also claims to have been influenced by such varied people as The Beatles, Paul Simon, The Mamas and Papas, John Lennon, Joni Mitchel and Aretha Franklin.

With all these strains of music in the melting pot, I at first wondered just what results would be obtained. On listening, however, I found that Tom has produced what to me is a very "listenable" record, although I am not able to list any definite reasons. Suffice it to say that as the recording quality is extremely good, this should be a must for the collections of jazz/rock enthusiasts. (D.W.E.)

★ ★ ★

MORE AMERICAN GRAFFITI. Varied Artists. MCA Records MAPS 7879. (Double Record Set).

If you're a rock fan with a yen for nostalgia, or if you saw the "American Graffiti" movie, then you'll like this collection of twenty five rock classics. Some of the tracks are introduced by "the howling, prowling Wolfman Jack", while featured artists include Bill Haley And His Comets, Little Richard, Buddy Holly, Carole King, The Platters and Brenda Lee, to mention only the relatively well known ones.

Only one track is included from the movie soundtrack, which has been previously released (MAPS 7038), so if you already have this, you need not fear "doubling up".

Considering the likely age of the masters, quality is quite good. Most, if not all, of the tracks are mono, and it is pleasing to see that none of them have been "electronically reprocessed for stereo". (D.W.E.)

★ ★ ★

AMARCORD, Music from the Fellini Film. M7 Records MLF .082.

Twelve pleasant tracks with a strong Italian theme make up the content of this sound track recording of Federico Fellini's film. Some of the tracks are: Amarcord—La "Fogaraccia"—Lo "struscio"—La Gradisca e Il Principe—Danzando Nella Nebbia—La Gradisca si sposa e se ne va. The musical content is easy to listen to but the quality of the review copy was pretty poor, with quite noticeable distortion on most tracks. (N.J.M.)

LIGHTER SIDE

IT HURT ME SO BAD. Gladys Knight & The Pips. Stereo. Astor Goldengroove Series TLP 9509.

Gladys Knight and The Pips have been around for quite a long time, and this shows in the polish that they give to their records. This one is no exception, and makes very pleasant listening.

For those unfamiliar with their style, this can be described as "sweet soul music". Imagine Diana Ross with a male backing group and you won't be far off the mark.

Featured titles are: It Hurt Me So Bad—A Love Like Mine—Bless The One—Linda—To Whom It May Concern—Walking In Circles—Darling—What Will Become Of Me—Come See About Me—Queen Of Tears. Record quality is excellent. (D.W.E.)

★ ★ ★

THE SPINNERS, BY ARRANGEMENT EMI EMC 3009 Stereo

If you don't know the Spinners too well, they are best described as a four man folk group with a large helping of exuberance. They send this twelve title record along at a cracking pace. Some of the titles are: Here's To The Couple—Any Complaints—The Collier's Rant—Bucket Of The Mountain Dew—Dip And Fall Back—When I First Came To This Land—So Long It's Been Good To Know You. In addition there is a wild, multi-lingual send-up of 'Everybody Loves Saturday Night'.

If you couldn't get a party started with this record it's time to give the game away. In a word, enjoyable! (N.J.M.)

★ ★ ★

A GENERATION OF CHILDREN'S HITS. Frankie Davidson. M7 Records Stereo MLX 081

The small fry will get a thrill from this collection of young-in-heart songs that have been favourites in recent years. Judging by the happy expressions on the cover, the young performers really had a ball making this record with Frankie Davidson. The titles are: Candy Man—Rubber Duckie—Old Grandad—Three Little Fishes—Puff The Magic Dragon—All I Want For Christmas Is My Two Front Teeth—Any Dream Will Do—I Want A Snorkersauras For Christmas—The Little White Bull—Oh Bullfrog—The Ugly Duckling—What A Mouth. It could be useful in getting a birthday party rolling. (N.J.M.)

★ ★ ★

STYX II. Styx. Stereo. Wooden Nickel (RCA) WNS-1012.

Styx is an American rock group, and this is their second album. Included in this album is their recent hit, Lady. Other titles are—You Need Love—A Day—You Better Ask—Little Fugue In "G"—Father O.S.A.—Earl Of Roseland—I'm Gonna Make You Feel It.

Judging by this effort, their style ranges from slower numbers all the way through the rock spectrum to hard rock. I found their music to make quite enjoyable listening, especially as the quality was so good—usually not one of the strong points of rock music! (D.W.E.)

AN EVENING WITH BELAFONTE/MOUSKOURI RCA LSP 3415

With two of the best known vocal artists together on one disc one can expect excitement and its certainly there in ten numbers of Greek origin. The titles: My Moon—Dream—If You Are Thirsty—The Train—In The Small Boat—The Town Crier—Walking On The Moon—The Baby Snake—The Wide Sea—Irene. The backing of bouzouki, guitars, violin and percussion suits the mood and helps round out an enjoyable performance. It is interesting to read on the cover notes that Belafonte was largely responsible for launching Nana Mouskouri's international career, after he heard her singing in a small club in Athens. (N.J.M.)

★ ★ ★

MISTY. Ray Stevens. Barnaby (Astor) BR 6012.

Ray Stevens seems to have left behind his earlier image as a "funny man" and embarked on a career as a ballad singer. As well as the title track, the following titles are included—Indian Love Call—Over The Rainbow—Oh, Lonesome Me—Sunshine—Cow-Cow Boogie—Young Love—Deep Purple—Mockingbird Hill—Take Care Of Business—Lady Of Spain.

Although at times he sounds like a young lad with a breaking voice, Ray still manages to produce a listenable album. Personally, his style does not appeal to me; I much prefer his earlier efforts. Record quality is excellent, with a good stereo spread. (D.W.E.)

★ ★ ★

SOUL!!! Various Artists. Stereo. RCA Victor SP-155.

This $4.99 album contains fourteen tracks by a total of seven different artists. Some of the more well known tunes are:

Another BBC organ record

THE ORGANIST ENTERTAINS. Various organists. Mono, BBC Records REC72M. (Distributed in Australia by Phonogram.)

Here's another "must" for the record collection of any enthusiast of the cinema organ. Taken from the BBC's own recordings of its popular BBC2 radio broadcasts, it features another group of big-name British organists who entertained in the golden era of the cinema. The generous program includes:

Amparito Roco (Charles Smitton)—I Cover The Waterfront (Jackie Brown)—Nola (Reg. Porter-Brown)—These Foolish Things (Ernest Broadbent)—Sentimental Gentleman From Georgia (Vic Hammett)—Bells Across The Meadow (Robinson Cleaver)—Alabama Jubilee (Robin Richmond)—Scherzo, Midsummer Night's Dream (William Davies).

On the other side, the same organists, not in the same order, present: Play Gipsy—Around Paris Medley—El Relicario—Kiss Me Again—Parade Of The Sunbeams—Ebb Tide—Parade Of The Tin Soldiers—Exodus.

Listening to these artists, the same reaction came through as from the other BBC historical recording reviewed recently: their complete command of the instruments in timing, phrasing and expression.

Technically, my particular pressing had an unfortunate buckle which compromised the outer tracks, but I would not expect other pressings to be similarly affected. That problem aside, the tracks are ageing mono, from the BBC library, but they are free from background noise and of adequate quality for enthusiasts to enjoy and appreciate this nostalgic music. (W.N.W.)

Pander Man—Knock On Wood—Gimme Little Sign—My Girl.

As the title would suggest, the record has a decidedly "soul" flavouring, and will appeal mainly to those with a taste in this direction. And although the artists are not well known to me, their performances are quite reasonable. Technically, the record is okay, so if this is your meat, go ahead and eat! (D.W.E.)

★ ★ ★

DIAMONDS. Neil Diamond. Stereo. MCA Records (Astor) MAPS-7541.

If you liked "Hot August Night", then this new Neil Diamond double album should appeal to you. Included among the twenty-five tracks are such favourites as—Cracklin' Rosie—Sweet Caroline—Holly Holy—Kentucky Woman—Song Sung Blue. These plus cover versions of—He Ain't Heavy . . . He's My Brother—If I Ever New Your Name—Mr. Bojangles.

Some live tracks are included although most originate in the studios. Although the quality of the live tracks is not impressive, overall the album is good technically. (D.W.E.)

★ ★ ★

THE LENA HORNE COLLECTION. United Artists, Festival release L 4553/4 $7.95 two record album.

Lena Horne should be familiar to anyone who enjoyed the big Hollywood musicals of the forties and fifties. As this twenty-four number release will show, she has lost none of her vocal skill and, with an orchestral and choral backing directed by Ray Ellis, we have a musical treat.

Some of the tracks are: I Get Along Without You Very Well—I Wanna Be Around—Wonderful Day Like Today—The Boy From Ipanema—Wives And Lovers—On Green Dolphin Street—What The World Needs Now Is Love—A Taste Of Honey—Never On Sunday—Moon River—A Fine Romance—Somewhere.

With its excellent quality and special price this album is a must for ballad lovers. (N.J.M.)

★ ★ ★

BARRY CROCKER Vol 2. Produced by Tony Hatch. Stereo, Astor TVS-1004.

If you liked the first "Barry Crocker" record—and who didn't?—then you'll certainly like this one equally well. Also produced in conjunction with Tony Hatch and his Orchestra, it brings together a dozen well known evergreens, mainly from the musicals, skilfully arranged and presented: Begin The Beguine—We Kiss In The Shadow (King And I)—Love Is A Many Splendoured Thing—So In Love (Kiss Me, Kate)—Who Can I Turn To (Stop The World)—Love Where Are You Now—I Talk To The Trees (Paint Your Wagon)—If I Loved You (Carousel)—On A Clear Day—Send In The Clowns (A Little Night Music)—C'Est Moi (Camelot).

Listening to these songs one can't escape the conviction that, while Barry Crocker made the headlines with ocker McKenzie, he will be esteemed in homes around Australia, Britain and elsewhere for just the opposite image—as a polished performer of music from stage and films. Recommended. (W.N.W.)

★ ★ ★

BODINE, RITA JEAN. Rita Jean Bodine. 20th Century Records L 35541 Festival Release.

Rita Jean is new on the scene, but she has been getting plenty of airplay on the local radio stations. In style, she could best be described as a "lady rocker", with quite a throaty voice.

Tracks on this album are: Dynamite—That's The Kind Of Love I've Got For You—Lickin' Stick—Old Friend—Dancing In The Streets—Change My Evil Ways—When You Hold Me—Hold On I'm Comin'—Lovin' Man—I've Been So Long.

My guess is that you will either like her, or dislike her, but in either case your feelings will be intense. Personally I liked her, probably because her style is so different. If you want to clear up any doubts, a good impression can be obtained by sampling the third track on side two. Record quality is excellent. (D.W.E.).

Books & Literature

Transistors

BEGINNER'S GUIDE TO TRANSISTORS, by J. A. Reddihough and I. R. Sinclair. Second edition, 1975. Published by Newnes-Butterworths, London. Hard covers, 127 x 193mm, 162pp, many diagrams and circuits. Price in Australia $5.00.

The second edition of this fairly well-known little book, the original of which came out in 1968 written by Reddihough. In updating it for the second edition, I. R. Sinclair has basically added new text and diagrams on silicon transistors and ICs, but has retained the original concept of a simple non-mathematical introduction for beginners with no previous knowledge of solid state devices.

It does not delve into any aspect of the subject very deeply, but tries to give a broad general idea of the concepts and techniques involved. As such, it seems to me a particularly easy to read and digest introduction—yet one which is at the same time sound and reliable. With this little book under your belt, you should find it easy to progress further into the subject if you wish.

Here are the chapter headings, which give a good idea of the material covered: 1—How the Semiconductor Works; 2—The Semiconductor Family of Devices; 3—First Steps in Transistor Circuits; 4—Audio Frequency Circuits and Techniques; 5—Radio Frequency Circuits and Techniques; 6—The Transistor as a Switch; 7—Power Supplies; 8—Integrated Circuits; 9—Some Hints for Fault Finding and Servicing.

Incidentally the last chapter is quite brief, but it gives a lot of useful and very practical information on simple fault finding and servicing in transistor circuits.

The review copy came from the local office of the publisher, who advises that copies should be in stock at all major bookstores. (J. R.)

Liquid crystals

LIQUID CRYSTALS FOR ELECTRONIC DEVICES, by Edward L. Williams. Published by Noyes Data Corporation, Park Ridge, New Jersey, 1975. Hard covers, 160 x 242mm, 262pp, many diagrams. Price in USA $36.00.

Another survey of the US patent literature from Noyes Data Corporation, this time concerned with the technology of liquid crystals and their application in electronics. It is listed as number 46 in their chemical technology review series.

By surveying all of the recent patents involving liquid crystal technology, the book is able to give a technically advanced and up-to-date review of the current state of the liquid crystal art. It should therefore prove a most valuable book for those interested in either making or using liquid crystal devices.

As with other Noyes publications, the book has been produced by "short-cut" publication techniques. The text is in the form of unjustified electric typewriter output, with illustrations copied directly from the patents. This together with offset printing ensures that the finished books are available much sooner than would be possible with a more traditional approach, adding considerably to the value of this type of book.

For those who must keep up to date with the rapidly moving liquid crystal field, then, this should be a very valuable acquisition.

The review copy came directly from the publisher. (J.R.)

Vintage radio

A FLICK OF THE SWITCH, 1930-1950, by Morgan E. McMahon. Published by Vintage Radio, Palos Verdes, California, 1975. Soft covers, 134 x 210mm, 312pp., many illustrations. Price $6.95 plus 50c packing and postage.

Another publication from Vintage Radio, for those with serious interest in old radio gear, collecting, or just with a love of the nostalgic. It is basically a survey of domestic radio and TV receivers in the USA, over the years between 1930 and 1950, with some additional general material on broadcasting, amateur radio, and electronics in this period. There are also brief sections on collecting vintage radios and basic radio theory.

There are all the classic US radio brands there, including Arvin, Attwater-Kent, GE, Crosley, Hallicrafters, Philco, Scott, Stewart Warner, and Zenith. They are represented not only by pictures of various models, but also in vintage press and magazine advertisements.

Most of the book consists of pictures with brief captions, with a relatively small amount of text in the general and introductory sections. To my mind this detracts from the appeal a little, as after a while one old set can look much the same as another. I feel sure that author McMahon has learned much more about them than he has recorded in this book, and it seems a pity that he didn't pass more of it on by way of text.

Still, even as it stands the book makes a very useful reference to domestic US radios of the period, and also very pleasant leisure reading. At the price it's certainly good value for money.

The review copy came from Dick Smith Electronics Pty Ltd, of 176 Pacific Hwy, Gore Hill NSW 2065, who advise that they have good stocks. (J. R.)

Data handbooks

TRANSISTOR EQUIVALENTS, 9th Edition, published by De Muiderkring B.V., Bussum, Netherlands. Soft covers, 313pp, 174 x 126mm. Suggested retail price $5.95.

TTL DIGITAL INTEGRATED CIRCUITS, Part 1, series 7400-74132 with equivalents, published by De Muiderkring B.V., Bussum, Netherlands. Soft covers, 296 x 210mm, 138pp, many diagrams. Suggested retail price $8.95.

THE WORLD'S RADIO BROADCASTING STATIONS & EUROPEAN FM/TV, by C. J. Both, published by De Muiderkring B.V., Bussum, Netherlands. Soft covers, 144 x 213mm, 223pp. Suggested retail price $8.95.

Three useful reference volumes from the Dutch publishing house De Muiderkring. The first is the 9th edition of their well known transistor substitution book, revised and extended by A. M. Hoebeek, and a mine of information for the service technician or hobbyist who must find a substitute for unobtainable devices.

The second is the first part of a new series of data manuals concerned with the ubiquitous TTL digital IC family. It is again the work of A. M. Hoebeek, and gives fairly complete data on some 725 different devices—many of them equivalents produced by various manufacturers. The devices are grouped together as equivalents, so that for example some 14 devices are grouped together over the "7400" data: SN7400N, MC7400P, FJH131, DM7400, FLH101, etc.

To facilitate easy use the book is provided with a complete device numerical index, a functional selector, an explanation of parameters and the ordering codes used by the various manufacturers. If you're working with TTL devices, it would make a valuable reference.

The third book is a guide for shortwave listeners and others interested in world HF, VHF and UHF broadcasting. It is thus vaguely similar to the well-known World Radio-TV Handbook, although it would be difficult to compare the two without

a detailed analysis. This volume appears to have somewhat less information overall, but the material is presented in a very concise manner, and may thus be deceptive.

Copies of all three books have been received for review from both the Technical Book and Magazine Company, of 289-299 Swanston St., Melbourne, and Dick Smith Electronics Pty Ltd of 176 Pacific Hwy, Gore Hill, NSW. Both advise that they have good stocks. (J.R.)

And two more . . .

SEMICONDUCTOR HANDBOOK part 1—Transistors, by A. E. C. van Utteren, published by De Muiderkring B.V., Bussem, Netherlands, 1973. Soft covers, 209 x 297 mm, 151pp, many diagrams. Price $6.90 plus 50c post and packing.

ELECTRONIC TUBE HANDBOOK, 16th edition, published by De Muiderkring B.V., Bussum, Netherlands, 1973. Soft covers, 118 x 220mm, 440pp, many diagrams. Price $6.90 plus 75c post and packing.

Two more data volumes from De Muiderkring in Holland. The first is a useful transistor data manual, listing brief specifications and connections for a very large number of European and US devices, together with some Japanese types. As such it would make a valuable addition to the reference shelf in service shops or the ham shack.

The second is the 16th edition of a well-established valve data handbook, covering a very large number of receiving and transmitting valves, industrial tubes and cathode ray tubes.

If you need a compact valve data handbook and don't want a lot of technical data on each type, it would be a good choice.

Review copies of both books came from Dick Smith Electronics Pty Ltd, of 176 Pacific Hwy, Gore Hill, NSW 2065, who advise that they have good stocks. (J.R.)

New catalog

WHK Electronic and Scientific Instrumentation, of 2 Gum Road, St. Albans, Victoria, has just published the sixth edition of its product catalog. Consisting of 72 pages 217 x 280 mm and printed on a durable glossy stock, the new catalog covers the wide range of products handled by the company—including TTL and CMOS ICs, linears, LEDs, displays, liquid crystals, switches, transducers, digital clock and frequency reference kits, optical filters and gratings, drafting templates, heat pipes and calculators.

The catalog also includes technical data on many of the more unfamiliar products.

Enquiries should be directed on company letterhead to the firm at P.O. Box 147, St. Albans, Victoria 3021.

New Products

New Philips test instruments

A quiet revolution has been taking place over the last few months in Philips Test and Measuring Instruments, with the assembly of a "new breed" of oscilloscopes, digital counters and multimeters. The new instruments offer modern styling, ergonomic design and highly competitive cost/performance ratios.

Perhaps the standard-bearers of the new Philips breed of instruments are the oscilloscopes. These are based on a compact integrated construction, in contrast with the "mainframe with plug-ins" approach. As such they offer high performance and functional flexibility, combined with a degree of compactness and portability difficult to achieve with the other type of construction. In fact even the "top of the line" model PM3265 is small enough to slip under one's aircraft seat—an important point for jet-setting trouble shooters!

There are currently 8 models in the new oscilloscope range. Babies of the range are the models PM3000 and PM3010, very compact "mini"scopes with 5MHz bandwidth and a display area of 18 x 27mm. Both are fully calibrated, offer high sensitivity, and operate from either the mains or an internal battery pack. The PM3000 is a single trace unit, while the PM3010 is dual trace. They both measure 80 x 125 x 196mm and weigh less than 1.8kg including battery.

Further up the range are the PM3232 and PM3233, true dual beam units with 10MHz bandwidth and an 80 x 100mm screen. Then comes the PM3234, similar to these but with variable persistence and storage.

Above these is the PM3240, a 50MHz/5mV instrument again with 80 x 100mm display but with dual timebases and beam switched dual traces. And above this again is the PM3260, a similar instrument in most respects except that it offers 120MHz bandwidth at 5mV sensitivity.

Finally there is the PM3265, again very similar except that it offers 150MHz bandwidth together with an analog multiplication facility of 100MHz bandwidth. The multiplier is provided with presets for zero balancing, which together with low drift gives it a very large useful dynamic range. A rear-panel multiplier output also extends multiplier usefulness considerably.

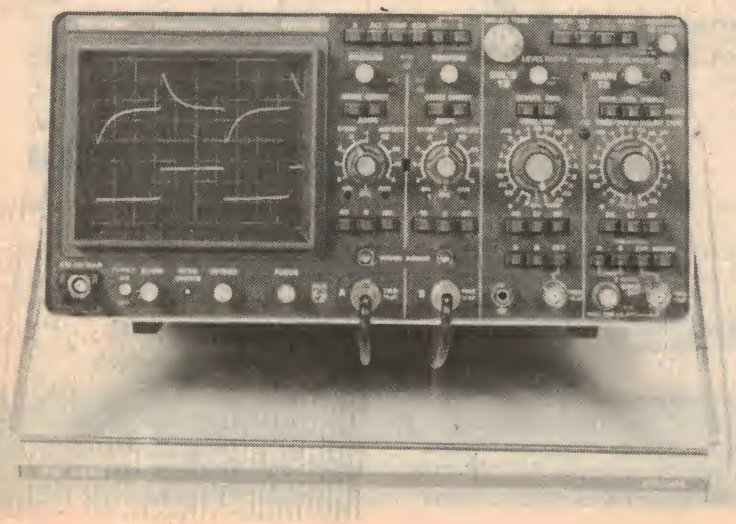
Apart from the new range of oscilloscopes, perhaps the most interesting additions to the Philips instrument range are a family of new digital counters. Five in number, these feature a 9-digit planar gas discharge display together with high sensitivity and compact construction. They also offer outstanding overload protection and noise rejection due to a PIN diode automatic input attenuator.

The models are PM6611 and PM6612, both offering 80MHz range but the latter with timing as well as counting; the PM6613, with 250MHz range; the PM6614 with 520MHz range, and the top-of-the-line PM6615 with 1GHz range. All have an input sensitivity of 10mV, and a choice of four different timebase options.

Other interesting new instruments are the PM2522, a high quality general purpose digital multimeter with 3½ digit display, and the PM2513: a new low cost 3½-digit digital multimeter designed for servicing in the field. The latter has an automatic 25-second reading cycle, after which it turns off to conserve the internal batteries. It features LSI circuitry, and a drop-proof case.

For further information on the new instrument range, contact Philips Scientific and Industrial Division offices in each state.

Below is the PM3265, top of the line model in the new Philips oscilloscope range and offering 150MHz bandwidth with a 100MHz analog multiplier. At right is the low cost PM2513 multimeter, with temperature probe, and below it the PM6613 200MHz 9-digit counter.



Reference source for colour servicing

An essential requirement for the correct adjustment of colour TV sets is a standard white light against which the white of the picture tube can be compared while the three colour channels and guns are adjusted. The "Color-Trak" reference source recently submitted for review by Parameters Pty Ltd is typical of the type commonly used overseas.

The standard white for colour TV is called "illuminant D", and approximates a colour temperature of 6500°K. Ideally, all sets should produce this white when displaying a known white signal, ie, from a test pattern.

Set manufacturers normally provide a suitable reference in their test booths, usually a colour tube displaying a blank raster, and suitably adjusted. It is essential that operators have such a reference continually available, in order that their judgement does not become impaired by other light influences, fatigue, etc.

Such a reference is no less essential to the installation technician or service mechanic, both of whom have to work under a wide variety of ambient light conditions. The "Color-Trak" is ideally suited to such applications, being compact enough and rugged enough to take into the field.

Another—very obvious—application for such a reference is to match sets for display in a showroom. Assuming that those in charge worry about this problem at all, some such reference is virtually essential if all sets are to display correct balance.

The device is basically a fluorescent tube with a colour temperature of 6500°K. This is housed in a substantial, neutral colour, acrylic tube, for protection, and also fitted with thick rubber ends, one of which serves as a handle.

Over the fluorescent tube is a four section step wedge, the brightest section of which gives a light level of 21ft Lamberts; the recommended peak white setting for colour tubes. The other three light levels are intended to provide a grey scale tracking check.

The ancillary equipment for the tube is housed in a small plastic encapsulated package coupled to the tube by about 12ft of cable. A further 3ft of cable connects the package to the power point.

The makers emphasise that, while made rugged enough for field use, it is also suitable for use in workshops, laboratories, or control booths. In the latter case it is suggested that it can be permanently mounted alongside a monitor screen.

The tube is claimed to have a minimum life of 5000 hours, is easily replaceable, and does not change colour temperature due to line voltage changes, or changes in ambient temperature.

Current price of the "Color-Trak" is $70.00 without sales tax. Further details may be obtained from the Australian agents, Parameters Pty Ltd, 68 Alexander Street, Crows Nest, NSW. The company has branches in all states, and representatives in several larger cities. (P.G.W.)

Marine communications unit

At the Sydney Boat Show recently, Weston Electronics Company introduced their Model 227 marine communications unit incorporating an 'emergency' capability. The low cost Weston 227 Transceiver is an ideal and versatile unit for the small ship user because it provides a 27MHz band transceiver, a broad cast band receiver, a loudhailer facility, and an 'emergency' capability in the 2182kHz band.

Emergency communication on the International Calling and Distress frequency (2182kHz) has previously been an expensive proposition because radio transceivers generally available are for comprehensive HF communications using relatively high cost Single Side Band (SSB) transceivers.

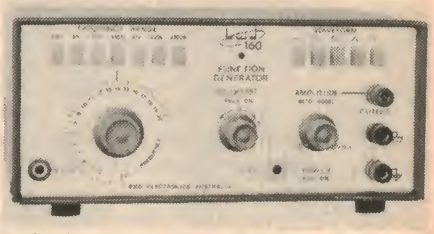
For further information contact Weston Electronics Company, a member of the wholly Australian owned Kemtron Limited group of companies, at 215 North Rocks Rd, North Rocks, NSW 2151.

NEW PRODUCTS

Function generator

A new high performance, modestly priced function generator has now been added to the BWD instrument range. Identified as the Model bwd 160, it has a frequency coverage from 0.02Hz to 2MHz in 7 decade ranges, with the selection of 12 different waveforms and 5 simultaneous outputs. It may also be swept over any four decades by an externally applied log sweep.

The main outputs of sine, square and triangle are available simultaneously at 1V p-p level on the rear panel, in addition to the main 600ohms output and a front panel TTL output which will handle 20 TTL loads. Maximum output is 20V p-p O/C or 10V p-p into 600ohms and is continuously variable over a 100-1 range. DC Offset may be switched in enabling the selected output to be positioned up to ±5V with respect to common.



Calibration is 3% of full scale above 2Hz and output is maintained within 2% into a 600ohms load paralleled by 15 pF. Sine wave distortion is below 1% between 10Hz and 200kHz and triangle linearity is better than 99% from 1Hz to 200kHz. Calibration is maintained between 10° and 35°C. The full operating range of 0 to 50°C only increases specification by a factor of 2. Sweep and Amplitude modulation for Model 160 is available in conjunction with a companion unit bwd 170 Waveform Modulator which provides linear or log sweep plus outputs for oscilloscope or recorder drive. The bwd 160 is very compact, being only 21cm wide x 10cm high and 21cm deep with a weight of 1.8kg.

Further information from B.W.D. Electronics Pty Ltd, 329-333 Burke Road, Gardiner, Victoria, 3146.

Products catalogue

Datametrics announce the availability of the "Timing Products Shortform Catalogue". This catalogue provides a complete listing in tabular format of standard Datametrics digital clocks, time code generators, time code readers and remote time display products. A brief description of the theory of operation of clocks and generators, as well as the application of time code for time synchronization, calibration, data indexing and time distribution systems is also provided.

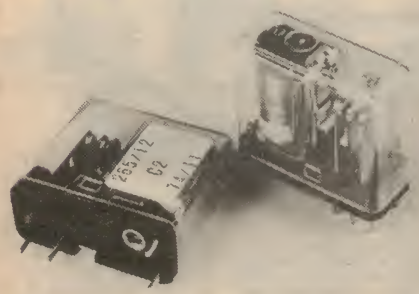
For additional information, please contact John Morris Pty Ltd, 61-63 Victoria Avenue, Chatswood, NSW 2067.

Push-button switches, miniature PC relays from IRH components

Designers of equipment using push-button switches will be interested to learn that IRH Components are now assembling and marketing "Schadow" isostat-style switches. The switches are available in assemblies of from 1 to 20 individual switches, and the switches themselves are available with 2, 4, 6, 8 or 10 changeover contact sets. Switch spacing options are 10mm, 12.5mm, 15mm, 17.5mm or 20mm.

A feature of the Schadow switch mechanism is that all moving contacts are spring loaded for reliable operation and low contact resistance. Another feature is dual connection fixed contacts: on one side they have pierced solder lugs for hand wiring, and on the other side stakes for PC mounting and soldering. PC standoffs are moulded into the casing, to ensure parallel mounting on PC boards.

A fully enclosed housing protects the contacts from dust. Contact resistance after 25,000 cycles is rated at from 6-20 milliohms. Dielectric strength is rated at 1500V, and switch contacts are rated at 500mA/100V AC, 200mA/250V AC and 1A/25V DC.



Also available from IRH are miniature PC mounting relays, type S265, from the UK manufacturer Magnetic Devices. Low in cost, the relays come with either SPDT or DPDT contact configurations, and coils for 6, 12 or 24V operation at a nominal 750mW dissipation.

Contact ratings are 5A at 30V DC or 250V AC non-inductive. Operating speed is 15ms to operate, 10ms to release including contact bounce. Inquiries to IRH Components offices in each state.

Low cost utility cases

A new line of low cost utility cases for electronic projects has been announced by Bespoke Metalwork, of 42c Sydenham Road, Brookvale, NSW. Designated type MT-1, the new cases measure 105 x 137 x 60mm and consist of a crackle-lacquer finished steel lower section with a brushed aluminium top section. The cases come in a variety of colours, including black, red and blue, and come complete with four small rubber feet and four assembly screws.

The cases should be available from most of the larger component suppliers.

Telephone answering machine

The "Doro" 320 telephone answering recording machine, recently approved for use in Australia by the PMG's Department, is claimed to be the most advanced unit of its kind in the world.

The unit is manufactured by Dictran International Corporation of San Francisco, USA, and features the International Compact Cassette world recording standard. It is voice operated, thus eliminating tape wastage and making the best possible use of available recording time.

Main feature of the Doro 320 is the remote transmitter unit which enables the unit to be completely controlled from a remote location, and allows the operator to change the outgoing text message at will. Control functions include Record, Stop, Start, Rewind and Backspace.

Other features include a monitor facility for screening incoming calls, a PMG approved two-way telephone message facility, and full transcribing facilities for use by a typist with foot control and headset.

Further enquiries to Modern Dictating Systems Pty Ltd, 75 Vulture St, West End, Brisbane, Qld 4101.

COME and SEE US!

at 554 Pacific Highway Killara

TC 506
5 watt

This is a superb hand held unit for the boating man. It's ready to use just as it is—nothing extra is needed to put a good powerful signal in the air. If you wish an external 12V supply can be used, or rechargeables can be fitted, but wherever you go, your '5 Watter' can go with you.

- 22 Semiconductors
- 6 Channel facility
- 12 Volt
- All metal case
- Tone call
- P.A. facility
- Modulation battery & RF meter
- Post & Pack $2.00
- Great value at

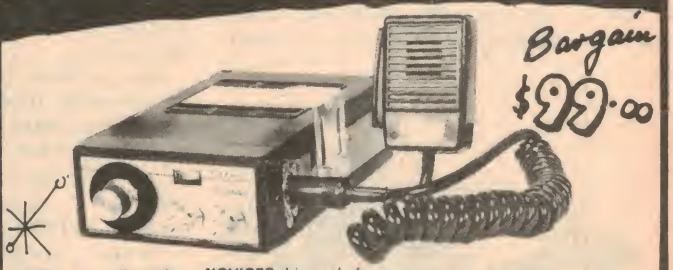
$119.00

CONTACT

Only 39.95

- 14 Semiconductors
- Squelch
- Tone call
- 2 Channel
- Earphone
- Strap
- Batteries
- Post & Pack $2.00

This must be the bargain of all time. No price increase yet but it can't last. We managed to get a special price on a huge quantity and we're passing the saving on to you. A full 1 watt in an all metal case.



Bargain **$99.00**

5040
TOKAI 5 watt

NOVICES this one's for you. Fully synthesised to give 23 American CB channels at the flick of a switch. Squelch & meter, press to talk mike complete with mounting cradle which can also be used as a desk stand. Very compact and highly efficient. Also available as a straight tranceiver TC5041 approved for boating. $119 (with 2 sets xtals)

- 32 SEMICONDUCTORS
- 12 VOLT DC • MINI SIZE
- FULL WARRANTY • PUSH
- TO TALK MIKE
- POST & PACK $2.00

SSB 15 watt by TOKAI

Fantastic Performer

This is the pride of our range of **TOKAI** Transceivers. Everyone wants to own this, but it's not cheap. How can it be with 81 semiconductors including F.E.T.'s. A magnificent sturdy metal case and all the goodies in the way of controls and facilities.

- 5 Watt AM—15W SSB
- Triple AM & Dual SSB Conversion
- AM. USB. LSB. & PUB. ADD.
- P & P $3.00

$199.00

TR18 UTAC 5 watt

Made by **TOKAI** branded **UTAC**

This is a handsome chunky 5 watt made for the American CB market with the full compliment of 23 American channels. You couldn't buy the bits for this sort of money. So get one while stocks last.

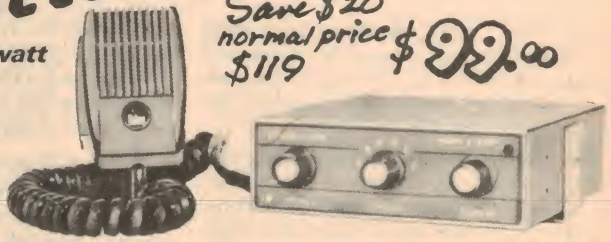
- 31 Semiconductors
- All metal case
- Fully synthesised
- P/T/T mike
- Cradle mounting
- 12 Volt DC
- PUB ADD FAC.
- P & P $3.00

Value at **$89.00**

BELCOM
5 watt

Here's a once only special. A compact 6 channel 5 watt. Fully P.M.G. approved for boating or base stations. Should cost $20 more but we bought the tail end of a stockpile at a good price. Snap this up because we can't repeat it. It's in an all metal case. Looks good on your desk or in your boat.

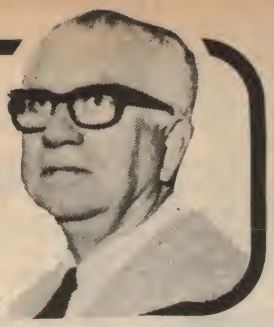
Save $20 normal price $119 **$99.00**



PETER SHALLEY COMMUNICATIONS 498211

The Amateur Bands

by Pierce Healy, VK2APQ



18th Jamboree-on-the-Air

Reports on three events are given in this month's notes; the 2nd North Queensland Convention, the 1975 Remembrance Day Contest, and the Jamboree-on-the-Air to be held on 18th and 19th October, 1975.

The 18th Jamboree-on-the-Air will be held over the weekend, 18th-19th October, 1975, starting at 0001 hours local time and terminating 48 hours later. These are suggested times and the World Scout Bureau advises that, if it is more convenient to commence on Friday evening, then do so.

It is stressed that JOTA is not a contest, but an opportunity provided by international amateur radio for scouts and scouting groups to exchange greetings with each other. Or, as expressed in the report on the 17th JOTA issued by the WSB, "JOTA has, indeed, something for everybody, whether it's the boy in Africa who discovers for the first time what a lift is, or the boy in the city who finds out how Eskimos really live in the Arctic.

"Activities such as JOTA mean a lot to boys in isolated communities; it is one of the few ways they have of 'meeting' fellow scouts."

The reference to Africa relates to one of the two stations which operated in Kenya.

"The station at Nakuru was in a five story building, and some of the scouts visiting it had never been in a town before. They were fascinated by the 'skyscraper' and the lift ride up to the station on the 5th floor. The thanks of the Kenyan scouts were to the members of the Radio Society of East Africa for their time and use of their equipment."

This is only one of the many examples of the educational aspects and fellowship which JOTA provides. It does not only apply to the less privileged communities but to technically advanced and highly populated areas.

In the 1974 event more than 80 countries around the world are known to have participated, providing a rewarding experience and a lot of fun for thousands of scouts and station operators.

An invitation is extended to all Australian amateurs to participate in the 18th JOTA, either by arranging to operate portable from the scout hall or by inviting small groups of scouts to visit their station. Besides providing a service to the community it will also be an educational and rewarding experience.

There are three basic rules for the event:

Amateurs may enter by calling "CQ Jamboree" or by answering other stations heard using that call.

Any frequency or mode available to Australian amateurs may be used.

All participants must strictly observe the terms of their licence.

Official world scout frequencies are:

CW—3590kHz; 7030kHz; 14.070MHz; 21.140MHz; 28.190MHz.

Phone—7090kHz; 14.290MHz; 21.360MHz; 28.990MHz. The 80 metre phone frequency is outside the Australian band.

Noel Lynch, VK4ZNI, national organiser for the 18th JOTA has advised that it is hoped that the Chief Scout of Australia, His Excellency The Honourable Sir John Kerr, KCMG, KStJ, QC, Governor General of Australia, will be available to again open Australian participation with a personal address over National Headquarters scout station VK1BP, Canberra.

Bulletins have been issued to branch organisers and girl guide associations with suggestions for those wishing to participate. In addition to direct contact with local scout groups contact may be made through branch organisers.

Branch organisers are:

NSW—Branch Commissioner Ray Lawrence, 45 Stanley Road, Epping, 2121.

Victoria—Assistant Branch Commissioner Paul Thomas, 1 Rosemary Street, Chadstone, 3148.

Tasmania—District Commissioner Ken Lane, 15 Nelumie Street, Lindisfarne, 7015.

Queensland—Branch Commissioner Alan Sherlock, C/- Scout Headquarters, 132 Wickham Street, Valley, Brisbane, 4000.

South Australia—Steve Johnston, VK5ZNJ, Flat 14, 13 Balmoral Road, Salisbury East, 5109.

Western Australia—Commissioner Peter Hughes, VK6HU, 58 Preston Street, Como, 6152.

SECOND NORTH QUEENSLAND CONTEST

What more pleasant way is there to enjoy a trip to the tropics during winter than to attend a radio convention. Such was my pleasure in late July, 1975. The convention was the second North Queensland organised by the Townsville Amateur Radio Club.

Having attended many conventions in various areas, I believe congratulations are thoroughly deserved by the organisers for providing such an interesting weekend of activities, coupled with excellent hospitality extended to their visitors.

Registrations were 100 adults and 37 children. In addition to visitors from Sydney and Melbourne, there were intrastate visitors from as far south as Ipswich to Cairns in the north.

Proceedings commenced on Saturday morning, 26th July, with registrations and inspection of commercial amateur equipment provided by Eddie Roach, VK4ZEZ for VICOM and Fred Bail, VK3YS, Bail Electronics. There was an almost continuous screening of technical and general interest films.

In addition there were well constructed items on display in the "Home Brew" competition. The winners in the various sections were:

Non-amateur technical: Rudolf Schumann – Digital stopwatch.

Amateur technical: 1st – Bob Grummitt, VK4RQ – 2 metre transverter. 2nd – Ron Melton, VK4ZLC – 2 metre 60 watt amplifier. Highly commended: Norbett Trupp, VK4ZPJ – 1296MHz transmitter and parabolic reflector.

The judging was by Professor Ward and Dr Herron of the Physics Department, James Cook University, Townsville.

One entry that created interest and conjecture was the Bruce Hughes, VK4BZ special. Bruce claimed it to be a most useful item in the shack as well as a technical achievement. But apparently the judges considered its serviceable life somewhat limited and on that score it did not make the winners list. The item was a brown glass bottle which appeared to contain 738.8 millilitres of "Home Brew" amber coloured fluid.

A non-technical competition was held for harmonics and XYLs.

Non-technical junior: Paul Hart (son of VK4TP).

Non-technical adults: Mrs Bertha Bell (wife of VK4LZ); 2nd – Mrs Doris Watson (wife of VK4DZ); Highly commended: Sandra Sebbens (daughter of VK4XZ).

These sections were judged by Dr Ward, wife of Professor Ward.

Three field contests on the 144MHz band were held:

a. Talk-in hidden transmitter hunt:
   1st – Rod Prior, VK4ZRC.
b. Hidden transmitter hunt:
   1st – P. Lindsay, VK4QD.
   2nd – W. Sebbens, VK4XZ.
   3rd – R. Melton, VK4ZLC.
c. A rather unusual hidden transmitter hunt:
   1st – Bill Gielis, VK4ABG.
   2nd – P. Lindsay, VK4QD.
   3rd – Ron Melton, VK4ZLC.

In the first event, the transmitter was a hand-held low-power FM unit, operated by Norbett Trupp,

A group of sucessful hunters reminiscing at the hidden transmitter location. Far left, VK4BZ, 3rd from left, VK4QD (winner), far right, VK4DZ.

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent direct to Pierce Healy at 69 Taylor Street, Bankstown 2200.

VK4ZPJ, from a mangrove tree in a Ross River tidal area. From comments made, it appears that because of attacks from insects which abound in such areas, Norbett's task was not without its hazards.

In the second event the transmitter was hidden by Bruce Hughes VK4BZ, assisted by his son Graham and accompanied by VK2APQ. The location was a vee shaped gully on Mount Louise and the signal was beamed at the TV towers on top of Mount Stuart. This caused some confusion among the hunters as a substantial signal was reflected by the steep cliffs of Mount Stuart. In addition there was a small grass and scrub fire to be negotiated after the correct track to Mount Louise had been located. This hazard also had to be overcome before the transmitter could be set up.

The third hidden transmitter was a low power FM unit hidden in a tree in one of the several parks in the western suburbs of Townsville, by Eddie Roach VK4ZEZ. Every five minutes Eddie recited a short rhyme containing clues as to his whereabouts. It is understood that the local aspiring poet laureates, Bruce VK4BZ and Eddie VK4ZEZ were collaborators in writing the rhymes which, while they would not have caused the proverbial maiden aunts to blush, bewildered the hunters considerably.

A point of interest; sniffers are not part of the north Queensland transmitter hunt equipment. But for the last event a stenographer or portable recorder would have been of considerable assistance.

During the afternoon, at the State Emergency Services Headquarters on the western side of Castle Hill, Professor Ward officially opened the convention. In doing so, spoke highly of the work and achievements in amateur radio.

The evening commenced with an excellent barbeque at the well appointed Senior Citizens Centre. The culinary arrangements were in the capable hands of John Felsman, chef at the Townsville Aero Club, where a special fish dish is barramundi prepared to John's own method.

The meal was followed by a family type social evening, including dancing, with numerous prizes, and the inevitable rag-chew and de-gassing of 809's.

The compere was Don Watson, VK4DZ with somewhat humorous assistance by Bruce, VK4BZ. A most enjoyable evening.

Activities on Sunday commenced with the WIA news broadcast. Then followed an interesting technical talk by Dr. Mal Herron at the nearby Queens Hotel. Dr. Herron spoke on IC's in computers and explained how science was giving back to amateur radio something in return for what amateur radio had given to science.

The winner of the first hidden transmitter hunt, P. Lindsay, VK4QD, (right) with the directional aerial he used.

The final session was the TARC art union draw and the presentation of prizes by club president, Ray Kearney VK4HE, followed by a very appetising smorgasbord lunch.

During the afternoon, Professor Ward provided an inspection of a radar installation at Kissing Point. This unit operates in the 21MHz range and is used in research relating to the ocean surface.

An item on display at the convention was the TARC 2 metre FM repeater VK4RAT (channel 1). Final tests and adjustments were being made prior to it being placed in service on Mount Stuart.

The call sign letters "RAT" may stand for "Repeater At Townsville" but among those closely associated with the device it is referred to as, "rat in a drain pipe". The reason being that it will be housed on Mount Stuart in a 2.5m dia. section of stormwater drain pipe, about 610 metres above sea level.

Other points of interest about TARC—There are about 80 amateurs in the Townsville area (pop. 85,000), of whom over 50 operate on 2 metres. Both commercial and home constructed SSB equipment is in use on 144.1MHz. In addition to repeater channel 1, 146.5MHz; 146.55MHz and 146.65MHz FM simplex channels are used. Intending visitors to the North Queensland area are urged to take VHF equipment with them as, due to tropical conditions, HF bands are not continuously monitored like the two metre band.

Contacts on 144MHz with Cairns, 290kM away, are considered commonplace; so much so that if two days pass without a contact, receivers become suspect. VK4ZEZ has worked Cairns and Mackay while operating mobile in Townsville. In mid-July John Roberts, VK4TL worked Mackay, from Cairns, 800kM away, on two metres.

The TARC six metre beacon VK4RTL transmits on 52.6MHz while 52.525MHz FM and 52.010MHz SSB channels are used.

In every day life TARC members are involved in many facets of commerce, industry, education, communication and science and are an integral part of the State Emergency Service. Some are still high school students, among these being VK4ZPJ, the youngest licensed amateur in North Queensland.

There is no illegal 27MHz activity in the area. Those interested in radio communication as a hobby turn directly to amateur radio. As the result, and because of service given during cyclone emergencies (such as that experienced two years ago) amateur radio is held in high regard by the community.

For adding many extras to the hospitality experienced at the convention, I express my appreciation to Eddie Roach, VK4ZEZ, chairman TARC technical activities committee; particularly the conducted tours of the area and a flight in a light aircraft around Magnetic Island and the city. Eddie, a meteorological officer, is also a highly qualified light aircraft pilot. Also, to George Smith, VK4GS for the conducted tour of the Invicta sugar mill at Giru.

Of course, in addition to meeting many for the first time, it was a pleasure renewing old aquaintances like Bruce Hughes, VK4BZ (VK4 convention Tullebudgera, 1958); Don Watson, VK4DZ (Region III inaugral conference Sydney, 1968) and Ted Gabriel, VK4YG whose WICEN activities in several areas have been recorded in these notes.

Finally to Hugh Barlow, VK4AM Queensland WIA contest manager, for the results of the 1975 Townsville Pacific Festival Contest.

The trophy was won by John Roberts, VK4TL with 493 points. The presentation was made by the previous year's winner Les Bell, VK4LZ, during the final session of the convention.

Section winners were:

a. Phone only—VK4XZ 229 points.
b. CW only—VK5DL 242 points
c. Open—VK4TL 493 points
d. Receiving—Tony Nance 284 points.

All eastern states were represented in the log entries received and Hugh expresses his thanks to all amateurs who participated in the contest and congratulates the section winners.

1975 REMEMBRANCE DAY CONTEST

The annual WIA Remembrance Day Contest between divisions of the Institute, to perpetuate the memory of amateurs who paid the supreme sacrifice in World War II, was contested over the weekend 16th and 17th August 1975. While some high contest numbers were heard being exchanged, these did not give a clear indication of band conditions as changes in the rules allowed additional contacts between stations on specified bands.

The opening address was recorded by the Hon. E. G. Whitlam, QC, MP, Prime Minister of Australia.

This is a resume of the address:

"I am honoured by your Institute for your kind invitation to declare open your 1975 Remembrance Day Contest. It is right that we should remember the amateur radio operators who laid down their lives for Australia in two world wars.

This occasion has taught me a little more about your useful and remarkable hobby.

". . . as amateurs you have been experimenting for many years with your own satellites and communicating with other amateurs as far afield as Africa and Japan. With the next generation of amateur satellites you will be able to contact your friends much further afield, in the USA and elsewhere.

"In these days of developing communications, Australians can pick up their telephones and have discussions with people around the globe at anytime, but the process is expensive.

"It is surprising indeed that you in your shack can talk at almost no cost with old friends and make new ones anywhere in the world. You are truly private ambassadors for Australia and I have no doubt that the world wide network of amateur radio communication, masses a valuable contribution towards international understanding.

"I commend your work in providing communications with stricken areas and your ability to move into action quickly when a natural emergency arises.

"My colleague, Senator Bishop, the Postmaster General, assures me that every possible facility is given to amateurs engaged in emergency traffic.

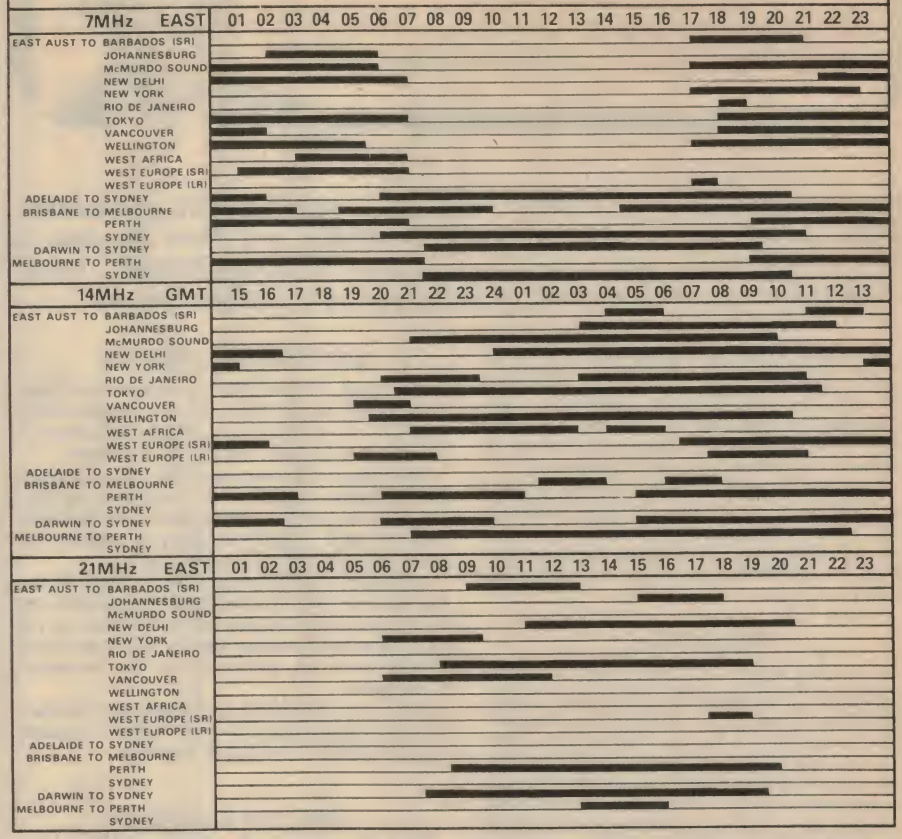
"At the present time you have training schemes, particularly in the Youth Radio Clubs, that are designed to widen your educational programs and bring the knowledge and experience of your exciting work to the widest possible audience.

"Young people today, with their natural zest for scientific knowledge and advancement will want to know more about your work and how they may participate in it.

"I have much pleasure declaring open the Wireless Institute of Australia 1975 Remembrance Day Contest".

IONOSPHERIC PREDICTIONS FOR OCTOBER

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 10.75



RADIO CLUB NEWS

RADIO CLUB DIRECTORY
A REMINDER THAT 16TH OCTOBER IS THE DEADLINE FOR INCLUSION IN DECEMBER 1975 ISSUE. FOR FORMAT SEE AUGUST NOTES.

WIA–ACT DIVISION: The August, 1975 issue of "Forward Bias", the division's monthly newsletter, drew members' attention to the necessity for increased fees. This is due to an increase in the amount required by federal executive. Also the proposed increase in postal rates will cause problems with the distribution of the newsletter.

Both matters were to be discussed at the September general meeting.

ILLAWARRA AMATEUR RADIO SOCIETY: QSL cards have been exchanged between VK2AMW and VE7BBG to confirm the EME contact between Australia and Canada and also the first 432MHz contact. A second contact was made on 3rd August, 1975 with signals peaking 6dB above the noise.

Further work is being carried out at the Moon bounce installation at Dapto by Lyle Patison, VK2ALU and assistants VK2AGV and VK2ZEN.

Work on the control and identification units for the new solid state repeater is progressing under the guiding hands of VK2AGV and VK2BHL.

For information on IARS write to secretary, PO Box 110, Dapto, 2530.

ST GEORGE AMATEUR RADIO SOCIETY: Publicity officer, Noel Spratt, VK2BSN, reports that there was a capacity house at the August meeting of the society. The main lecture for the evening was given by Grahame O'Brien, VK2ZZV. The subject—refrigeration. The second was a talk by George Hodgson, VK2OH, on a moderately powered linear amplifier project. There was also a short discussion on solid state converters by Roger Harrison, VK2ZTB.

It was reported that the St George repeater was showing it would be capable of a good performance, when installed at its permanent location at Heathcote.

Meetings: 1st Wednesday each month, Rockdale Civil Defence Headquarters, Highgate Street, Bexley, at 7.30 pm.

BLUE MOUNTAINS BRANCH NSW DIV. WIA: In accord with its "outreach" policy the branch put on an amateur radio demonstration at the Springwood Scout Hall. The event was well attended. Plans are also in hand to assist local scout groups in the 18th Jamboree-on-the-Air.

Equipment donated by branch members has been distributed to the branch's "YRCS satellite clubs", operating in the following high schools; Penrith, Whalan, Springwood, Katoomba and Cowra. Incentive packets of useful components will be presented to successful YRCS examination candidates.

The branch also cooperated with the NSW State Sport and Recreation Services' Parramatta office in conducting a vacation course in radio communication, during the August-September school vacation. This is the first radio course sponsored by the SSRS and is a pilot course which could be repeated and extended in future vacations.

Representations have also been made to the Blue Mountains Library to build up the radio-electronics section of the council library service.

At the beginning of 1975, Mr Brian Kleinschafer, of the Science Department, Katoomba High School, started an electronics course approved by the education department. His fifth form students have made excellent progress. There is keen competition to see who gains a prize to be awarded by the Blue Mountains Branch.

The latest project being undertaken by the branch is the construction of a repeater. John Oxley, VK2YCO has been appointed project officer.

Remember the Branch's annual field day on 23rd November, 1975, at North Springwood Community Hall.

WESTLAKES RADIO CLUB: The committees of the WRC and the Hunter Branch NSW Division, WIA have combined to arrange a field day at Teralba on 2nd November, 1975. The event promises to be one of the most interesting yet held.

The day will mark the official opening of the club rooms in York Street, Teralba. In conjunction with the field day and to assist the WRC building fund an Amateur Station Equipment Contest—1975, is being run. The prizes will be in excess of $1000. Tickets at $2 each are available from the secretary, PO Box 1 Teralba 2284.

Shortwave Scene

by Arthur Cushen, MBE

The Vatican Radio is currently installing a new 500kW transmitter. When completed, a new service to Australia and New Zealand is expected to come into operation between 0700-0800GMT. Other major transmission time changes are expected to be announced.

The present transmission from 2210-2225GMT in English is on 7235, 9615 and 11705kHz. Recently a new frequency of 11950kHz was tested for four days as a replacement for 11705kHz. The tests in this area were most successful, but in Japan interference on 11950kHz was experienced from Saudi Arabia.

The station advised that in the meantime they will use 11705kHz for transmissions to Japan, Australasia and the Philippines, which are broadcast in a block from 2150-2240GMT. Transmissions to Japan and the Philippines are on the air Mondays, Wednesdays and Fridays.

TWR GUAM

Trans World Radio, which has Gospel programs originating from Monte Carlo and has relay stations on Bonaire, Cyprus and in Swaziland, has now made final arrangements for its new station in the Pacific area. The organisation has received a licence from the Federal Communications Commission in Washington, USA, for a broadcast station on Guam.

Current plans call for a medium-wave station which will operate on 770kHz with the power of 10kW. In addition, two shortwave transmitters of 100kW will be installed later, and these will enable Radio KTWR to broadcast its Gospel message to a wide area of the world. The coverage of the station will be directed to nearly half the Earth's population in China, Southeast Asia, Eastern Russia and Australia.

KTWR has the mailing address of PO Box 3518, Agana, Guam 96910. The transmission in this area on 770kHz suffers interference from the 500kW transmitter of JOUB at Akita, Japan.

INDONESIAN SIGNALS

Robert Yeo of Melbourne has received a verification from Radio Daerah Kabupatan Serang in Indonesia. The station operates on 3117kHz according to the following schedule: 2245-0200GMT, 0400-0700GMT and 0900-1600GMT on Sundays, and 2245-0730GMT and 0900-1600GMT on other week days.

Craig Tyson of Wembley, Western Australia, has heard Radio Pemerintah Daerah Kabupatan Lamongan on 2865kHz. Programming has been in the form of a Djakarta news relay in Indonesian at 1500GMT. Other Indonesian signals observed are:

- Radio Pemerintah Daerah Kabupatan Karanganyar, heard on 3043kHz with station identification in Indonesian at 1359GMT followed by Indonesian songs and announcements;
- Radio Republic Indonesia at Jember, heard on 3323kHz with station identification at 1458GMT followed by the Djakarta news relay at 1500GMT;
- Radio Republic Indonesia Bogor, heard on 3952kHz with a Djakarta news relay at 1300GMT and a news relay from Bandung at 1400GMT.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add 8 hours for WEST, 10 hours for EAST and 12 hours for NZT.

RADIO SWAN VERIFIED

Last month we gave details of reception of Radio Swan operating on 6185kHz and heard around 0700GMT. From the announcements, we believed it to be located on Swan Island in the Caribbean.

Ray Crawford of Invercargill, NZ, has received a letter in English, indicating that the station is not located on Swan Island, but at San Pedro Sula. The letter gave the medium-wave frequency as 1100kHz and the shortwave frequency as 6185kHz.

According to the President of Radio Swan, the station has been formed to broadcast to Cuba following the closure of the CIA operated Radio America. The latter broadcast from Swan Island which was recently handed back to Honduras by the American Government.

Radio Swan promises to send souvenirs to listeners. The verification letter came from Ralph H. Nodarse, Apartado 882, San Pedro Sula, Honduras.

OSLO BROADCASTS

Radio Norway, in its broadcast to the Pacific, is now using some new frequencies. The transmissions are in Norwegian, except on Sunday when the last 30 minutes is in English. The three broadcasts beamed to this area are as follows: 0500-0630GMT on 11850, 11870 and 15170kHz; 0700-0830GMT on 5965, 11895 and 17795kHz; and 1100-1230GMT on 5965, 15345 and 21655kHz.

AFAN VERIFIES

A verification has been received from the American Forces Antarctic Network by Paul Aronsen of Invercargill. AFAN McMurdo was first heard on 6012kHz last year and later noted on 7050kHz. The reason for the change in frequency was to avoid interference caused to a satellite tracking station in the area.

The station in its letter indicated that other frequencies would be tested before applying to the American Authorities for a permanent channel to carry AFAN broadcasts on a 24 hour a day basis.

TWR SWAZILAND

Trans World Radio, which broadcasts from Manzini in Swaziland, has been heard on 9590kHz by several New Zealand listeners at 0500GMT. John Mainland and Bryan Clark of Wellington, New Zealand, report reception up to 0600GMT, with English announcements and programs from 0530GMT.

Colin Miller, reporting in the New Zealand DX Times, states that Trans World Radio-Swaziland, Southern Africa's only Christian Radio Station, began broadcasting on 1 November, 1974, from a site eight miles from the Swazi capital Manzini. Two 30kW transmitters are already in operation, with log periodic antennae used to beam religious programming as far north as Tanzania and Angola. English, Afrikaans, German, Portuguese and Shona languages are currently aired, with 14 further African dialects planned, including Swahili.

PAKISTAN BROADCASTS

According to a verification from Radio Pakistan the station is keen to receive reception reports on two transmissions beamed to this area. These are the transmission of slow-speed news in English from 0230-0245GMT on 15205 and 17830kHz and the World Service for South East Asia from 2345-0045GMT on 9460, 11885 and 15205kHz.

The verification letter received was signed by M. Sarwar Sheikh and came to us via the Pakistan Embassy in Canberra. The address for reports is: Pakistan Broadcasting Corporation, 35-A, Satellite Town, Rawalpindi, Pakistan.

MEDIUM WAVE NEWS

BRUNEI: A new 10kW transmitter for Brunei is currently being installed by Marconi for medium-wave operation. Located at Bandar Seri Begawan, it will be used to double the output power of similar equipment supplied some time ago. Delivery of the new medium-wave equipment will be complete by 31st December 1975. Brunei is using 895, 1100 and 1240kHz for its medium-wave operations.

PHILIPPINES: A verification from DZWT indicates that they now use 10kW on 540kHz. Reception has been possible up to sign-off at 1600GMT. The station address is: Mount Province, Broadcasting Corporation, Box 71, Baguio City, Philippines.

AMERICAN SAMOA: 'Radio Samoa' is now the slogan used by the former WVUV at Pago Pago on 1120kHz. In New Zealand, good reception is possible in the early evening. The station has commercials and announcements in both Samoan and English and now operates 24 hours a day.

INDONESIA: Surabaja is using 1385kHz as well as 1206kHz from 1300 to 1600GMT. According to ADXN, Radio Commercial di Djakarta is continuing to use 1565kHz for its broadcasts.

UNITED ARAB AMINRATES: 'Ra's al-Khaymah' is reported by the BBC Monitoring Service as operating on 1175kHz up to 2000GMT. All programs are in Arabic except for the period 1100-1200GMT daily, which is in English.

LISTENING BRIEFS

EUROPE

FRANCE: Additional frequencies are now being used by Radio France in its only English transmission, which is heard at 1700GMT for an hour. Paris Calling Africa has been observed on 15200, 15210, 15300, 15360, 15425, 17720, 17800 and 17820kHz. Also announced are 5955, 7285, 9505 and 21620kHz.

HUNGARY: Radio Budapest has extended its broadcasts for the shortwave listener and the radio amateur and now includes information on these subjects at the conclusion of the English transmission each day. The broadcast to North America from 0300-0330GMT is best received on 9833kHz.

POLAND: Warsaw, in its English transmission to North America, has been heard on 11810kHz at 0300GMT. The station does not list the frequencies in its schedule, only the metre bands.

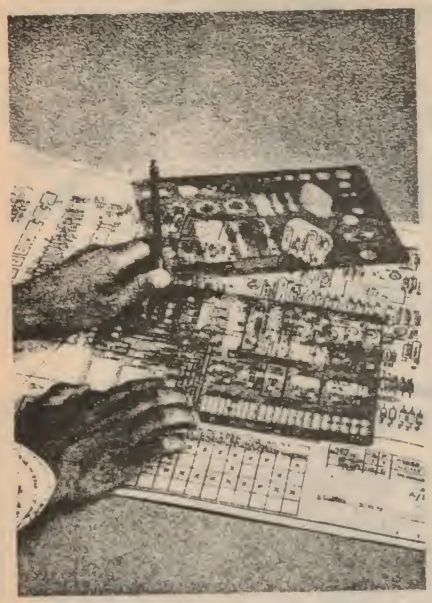
ASIA

BANGLADESH: According to Bob Padula of Melbourne, Radio Bangladesh in Dacca now uses 17720kHz, instead of 17890kHz, for its transmission to the Middle East from 0445 to 0545GMT. The languages used are English until 0515GMT and Arabic till sign-off.

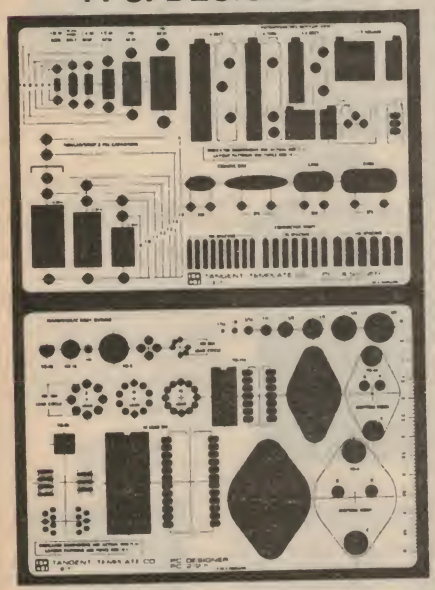
SRI LANKA: The All Asian Service of the Sri Lanka Broadcasting Corporation has been heard on 9720kHz on Sunday with a Gospel program up to 0200GMT, followed by the BBC news. The latest schedule published in 'DX Digest', Calcutta, India, gives the broadcast from Colombo as 0030-0430GMT on 6075, 9720 and 15425kHz and 1230-1730GMT on 7190, 9720 and 15425kHz.

OMAN: Radio Oman is reported in the New Zealand DX Times with an English test transmission on 3330kHz at 1730-1800GMT. The station asks for reception reports to be sent to: The Secretary of Information, Ministry of Information, PO Box 600, Muscat, Sultanate of Oman.

PRINTED CIRCUIT DRAFTING TEMPLATES



P. C. DESIGNER®



The P. C. DESIGNER® is a comprehensive template set for printed circuit layouts and assembly drawings. Component body outlines, layout patterns, and pad diameters conform to guidelines established by MIL-STD 275 and The Institute of Printed Circuits bulletin IPC CM-770. All component mounting patterns are on grid centers and are compatible with automatic insertion equipment.

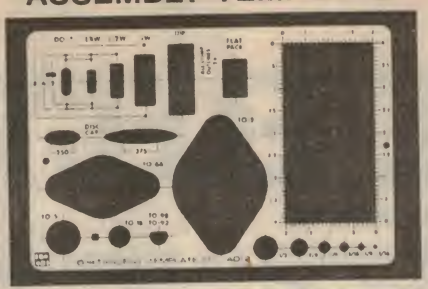
Template number one contains body outlines and layout patterns for composition resistors, 8 sizes of axial lead capacitors, and 4 sizes of radial lead capacitors. 7 styles of potentiometers and 3 popular connector patterns are also included.

Template number two contains TO-5, TO-18, and TO-92 body outlines. 3, 4, and 6 lead patterns are available on a .200 diameter lead circle. 8, 10, and 12 lead patterns are on a .400 diameter lead circle. TO-86 flat pack outline is featured with both welded and inserted lead patterns. 14 and 24 lead dual in-line patterns, TO-3, and TO-66 outlines, a 6 inch scale and handy circle guide complete the template.

The P. C. DESIGNER® is available in 1:1, 2:1, and 4:1 ratios.

Set number PC-1 (1:1) $13.80
Set number PC-2 (2:1) $16.10
Set number PC-4 (4:1) $23.00
(PC-4 is a four template set.)

ASSEMBLY TEMPLATE



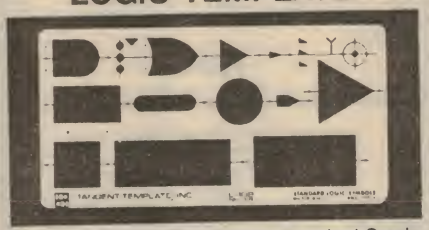
This template is designed especially for printed circuit board assembly drawings. It allows rapid detailing of the most commonly used components in the electronics industry.

The template is also useful when laying out printed circuit boards. The component patterns are helpful when arranging parts on the board, preventing interference between components on the final product.

The template is available in 1:1, 2:1, and 4:1 ratios.

Template number AD-1 (1:1) . . $4.02
Template number AD-2 (2:1) . . $5.17
Template number AD-4 (4:1) . . $8.05

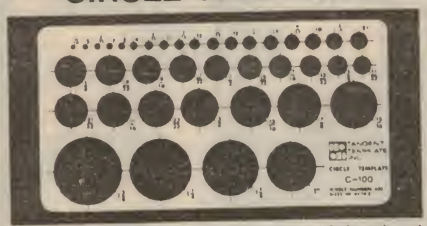
LOGIC TEMPLATE



The "L" series templates feature standard Graphical symbols conforming to MIL-STD 806C and ANSI Y32.14. The Standard Logic Symbols Template is available in four drawing sizes.

Template number L-108 Full Size $3.45
Template number L-106 . ¾ Size $3.22
Template number L-104 . ½ Size $2.99
Template number L-103 . ⅜ Size $2.76

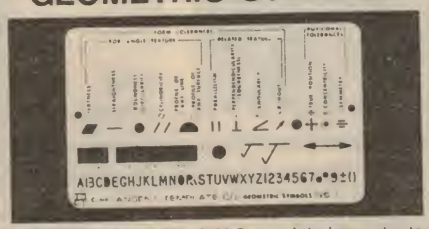
CIRCLE TEMPLATE



The C-100 circle template features 39 fractional size circle guides from 1/16" to 1-3/8".

Template number C-100 .....$1.43

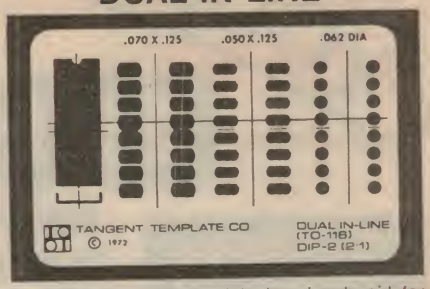
GEOMETRIC SYMBOLS



The GEOMETRIC SYMBOLS template has cutouts for all symbols required by ANSI Y14.5 and MIL-STD 8C.

Template number GS-1 .....$4.60
Template number GS-2 .....$2.30
(As shown, except without lettering guide.)

DUAL IN-LINE

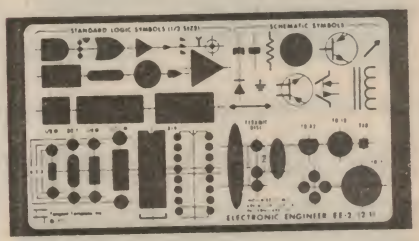


The DUAL IN-LINE template is a handy aid for layout of printed circuit boards using either the 14 or 16 lead TO-116 (DIP) package. Circuit pad patterns, any of the three most popular pad sizes, can be quickly drawn on a layout without moving the template. A must template for laying out integrated circuit patterns from the simplest to the most complex.

The DUAL IN-LINE template is available in 1:1, 2:1, and 4:1 ratios.

Template number DIP-1 (1:1) . . $2.30
Template number DIP-2 (2:1) . . $2.87
Template number DIP-4 (4:1) . . $3.45

ELECTRONIC ENGINEER'S DRAFTING AID



The ELECTRONIC ENGINEER template series incorporates on each template the most useful logic, schematic, and component layout patterns necessary for the majority of electronic circuit design requirements.

Each template features a complete set of standard logic symbols meeting ANSI Y32.14 requirement. Additionally, the most useful schematic symbols for creating usable schematic and logic diagrams are included. Completing the template are the basic component layout patterns required for laying out and detailing electronic assemblies. Featured are basic resistors, capacitors, and semiconductors used in most electronic equipment.

The ELECTRONIC ENGINEER template is available in 1:1, 2:1, and 4:1 layout ratios.

Template number EE-1 (1:1) $5.75
(¼ Size Logic Symbols)
Template number EE-2 (2:1) $6.90
(½ Size Logic Symbols)
Template number EE-4 (4:1) $8.05
(¾ Size Logic Symbols)

post & pack $0.80 per order

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	(1) of	(5) of	(10) of
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EL7L — 7'' 1200'	$6.50	$6.00	$5.50
ED7 — 7'' 2400'	$8.00	$7.50	$7.00

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4001-1C —	56c	2N914 —	25c
4017-1C —	$4.20	BZX79/c6V2 —	50c
4013-1C —	$1.60		

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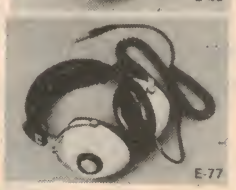
$13.95



CORAL STEREO HEADPHONES

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E-77 — $14.50

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MVA6.VTVM —	$73.60
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VM150 FET VOM —	$63.25

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MVA — 100CN

Features: Resistance measurements 0.1 Ω to 200M Ω; A.C. and D.C. Current up to 10A; 100K Ω/Volt sensitivity; 25 kV probe available; Diode overload protection; Polarity reversing switch; Special battery compartment; 4 mm terminal sockets; Unique handle forms bench stand; Spring loaded, shock resistant movement.

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MVA-50

Features: 46 Ranges; D.C. Current up to 10A; 50 K Ω/Volt sensitivity; Diode overload protection; 4 mm terminal sockets; Unique handle forms bench stand; Shock Resistant Movement.

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Features: 20K Ω per Volt sensitivity; OFF position on switch; Modern appearance, with recessed; Meter & knobs; Diode overload protection.

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Case to suit $4.60

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Features: Very large clear scale; Unique handle to form bench stand; A.C. and D.C. voltage up to 5KV; D.C. Current to 10A; 4 mm terminal sockets; Diode overload protection; OFF Switch position.

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CAB34 1250 Ω VP2 **$5.20.** CAB12 185 Ω VP2 **$4.50.** CAB12 430 Ω VP2 **$4.80.** Bases VP2 **$0.96c.** Bases VP4 **$1.10**

INFORMATION CENTRE

RESISTOR WATTAGE: How many watts would a resistor have to be if it has to drop voltage from 47V to 6V at 150mA (a 330 ohm resistor)? Also I have experimented with audio filters (series LC) but none of them seem to have resonated. I had them hooked up to a meter but the needle moved only slightly. I had an oscillator which had a wide range. What sort of waveform do you need to get good results? I am going to have a go at designing a radio control system using filters. (K. R., South Oakleigh, Vic)

● Using Ohms Law to calculate the resistor value, the result is 273 ohms. The closest preferred value would be 270 ohms. There are three different calculations for power but perhaps the most direct is to simply multiply the voltage across the resistor by the current through it. This yields a result of 6.15W, which means that the smallest resistor you could use would be 7W.

When testing a series LC filter for resonance, the correct method is to feed it via a suitable resistor and then monitor the voltage across the LC network. When the input frequency is in the region of the resonance there will be a sharp dip in the voltage reading on the meter. For best results, use sine waves.

CASSETTE RECORDER: Referring to the general purpose amplifier described in January 1975 issue (File 1/MA/50), would it be possible to connect it to a cassette recorder? If so, could you please tell me how this could be done and what modifications would have to be carried out to either. Congratulations on such a good magazine. (L. M., Geelong, Vic).

● We must point out that such queries are really beyond the scope of our Information Service. In any case you have not provided us with any specific details of your recorder or nominated what your purpose is, eg, playback, recording or both.

TURN SIGNAL AMPLIFIER: Is it possible to make a circuit to amplify the turning indicator for a car or motorbike? It is difficult to hear the clicks and it is very easy to forget to turn the indicator off. A speaker may not be suitable on a motor bike because it is in the open. What can you advise? (R. T., Nasville, Qld).

● A device of the type you require was described in the "Reader Built It" section in June 1970. (File No 3/MS/23). It does use a speaker, but points out that this doesn't need to be a good one for this purpose.

DIGI-METER: Recently I purchased two AD2010/E panel meters and I have built one Digimeter as described in October 1973 (File 7/M/45). The instrument works well on the upper four DC ranges. On the ohms ranges I have a problem: switching the meter to any of the ohms ranges, the readout indicates an overload (three zeros flashing) while shorting the common terminal to the ohms terminal indicates a constant three zeros on the readout. I have tried different transistors but the result was the same. After making other alterations

I found that by connecting a known resistor across the ohms terminal I can obtain a reading and calibrate that range but as soon as the resistor is removed the meter is flashing. Also the last two digits are changing continuously (12.00 to 12.30) that happens on volts and ohms, on the 200mV range the meter is counting from −80−100 to +100 with open terminals.

All resistors are 1% high stability, the voltage regulator is an LM309K and I notice a 30-35mV variation at its output due to line variation—is that variation normal? Can you please assist me to find the faults? (A.M., Sturt, SA.)

● As you can see, A.M., we have shortened your letter a little but the nitty-gritty is still there.

First of all, it is normal for the meter to flash when switched to the ohms ranges and with the terminals open-circuit. This represents the overload condition caused by the transistor current source feeding too high an input voltage into the panel meter. No harm is caused by this condition. When you short out the terminals, you then obtain a corrects reading of three zeros.

The second "fault" we find hard to diagnose since your description "the last two digits are changing continuously ..." seems a little vague. However, it is fairly normal for a high impedance DVOM to have a varying reading on low ranges such as 200mV FSD when the terminals are open-circuit.

As far as the LM309K regulator is concerned, the degree of output variation seems relatively large considering the expected line voltage and transformer regulation. On the other hand, if there are large spikes superimposed on the incoming mains voltage then the output variations from the regulator would quite likely be normal.

FUNCTION GENERATOR: Thank you for the fine article on the function generator in the February 1975 edition. I have two questions about the article.

To use the sweep facility, wouldn't it be simpler to use a 2000uF capacitor across a 7.5V battery, and switch off the battery supply? This would seem to be a much cheaper alternative for the odd occasion that the sweep would be required.

You often mention the use of "Scotchcal" in articles. What is it? and who can supply it? I have never seen any of your advertisers mention it, and it is not known where I live.

Thanks also for the telephone exchange item in July 1974, and for the extra's in December 1974. More articles of this type would be most welcome. (D.S., Carnarvon, W.A.)

● Thank you for your comments about the magazine, D.S. The sweep facility of the function generator can be used in the manner you describe, and will give quite satisfactory results. Scotchcal is a photosensitive aluminium sheet, supplied with an adhesive backing. Labels and front panels can be made using transparent artwork negatives, and these can then be placed in position as required. It is made by the 3M Company.

CCTV: I would like more information on an article in the July 1973 issue about a Nivico CCTV video tape recorder and camera. I would like to have more information of prices for the cheapest sound and picture video tape recorder. Please send me all the information you can on the AWA-Rediffusion company. (D.M., Melville, WA.)

● Unfortunately, we cannot provide any more information on Nivico CCTV equipment. We suggest you contact the Australian distributors, AWA-Rediffusion Pty Ltd, at their address in Western Australia, 231-233 Bulwer Street, Perth.

VOLUME COMPRESSOR: I have been trying to procure components or a kit for your IC Volume Compressor featured in February 1970 (File 1/M/13). Unfortunately, it seems impossible to procure any LM370 ICs for this device. Could your staff suggest an alternative IC for this project or another circuit using conventional components for a volume compressor. Your help would be much appreciated. (J.H., Richmond, NSW.)

● We assume you have contacted the major kit-set suppliers in Sydney, and NS Electronics who are the supplier of the LM370. Failing that, a circuit using discrete components was published in June 1968 (File 1/M/12).

CONVERTING FM RADIO: I have a portable 6 band receiver with the frequencies 540-1600kHz, 4-12MHz and 74-174MHz. I saw your stereo-decoder in April E.A. and I thought about building it as my receiver is mono, but one question opposed me. As you have to remove the capacitor and possibly short the resistor in the original de-emphasis circuit, would this affect the other bands, such as the AM band, through the receiver speaker?

I would also like to build an electronic humidity tester, similar to a thermometer. Could you help? (J.P., Lindfield, NSW.)

● Since it is only for FM transmissions that the signal is given a high frequency emphasis, de-emphasis is only applied to the FM section of a receiver. This means that removal of these components to enable use of the stereo decoder should not affect other bands, such as the AM band. We have never published a project concerned with measuring humidity, so we are unable to help with your last request.

(Cont. on p. 106)

If you are unable to complete an "Electronics Australia" project because you missed out on your regular issue, we can usually provide emergency assistance on the following basis:

PHOTOSTAT COPIES: $2 per project, or $2 per part where a project spreads over multiple issues. Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

METALWORK DYELINES: Available for most projects at $2 each, showing dimensions, holes, cutouts, etc., but no wiring details.

PRINTED BOARD PATTERNS: Dyeline transparencies, actual size but of limited contrast: $2. Specify positive or negative. We do not sell PC boards.

REPLIES BY POST: Limited to advice concerning projects published within the past 2 years. Charge $2. We cannot provide lengthy answers, undertake special research or discuss design changes.

BACK NUMBERS: Only as available. Within last 6 months, face value. 7-12 months, add 5c surcharge; 13 months or older, add 10c surcharge. Post and packing for 60c per issue extra.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee, for reply in the magazine, at the discretion of the Editor.

COMMERCIAL, SURPLUS EQUIPMENT: No information can be supplied.

COMPONENTS: We do not deal in electronic components. Prices, specifications, etc., should be sought from advertisers or agents.

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

INFORMATION CENTRE

MODEL CONTROL: I would like to convey to you the pleasure I derive from reading your excellent magazine. In the March issue, I found reference that you might publish an article on model radio control. I am certain that when printed this article would be immensely popular. (R.H., Earlwood, NSW.)

● Thank you for your kind comments regarding the magazine R.H. Unfortunately you appear to have read more into our answer to a previous correspondent than we intended. We have no plans at this stage for describing a radio control unit for models, and can only promise that such a project due consideration in the future.

FACSIMILE EQUIPMENT: Thank you for publishing an excellent magazine which I have read since its inception. Do you contemplate any constructional articles on facsimile? I would like to correspond with any readers who may have experimented with facsimile, as I am interested in receiving the weather maps etc which are regularly broadcast on HF. (R.C. Hope, 18 Dundilla Rd, Frenchs Forest, NSW 2086.)

● Unfortunately R.H., we are unable to be of much help on this occasion as we never described a project along these lines. However, we have published your name and address in full so that any interested readers may contact you direct. Thank you for your kind comments regarding the magazine.

RIAA EQUALISATION, EARTH LOOPS: I have recently read your article on the Playmaster 143 in September/October 1974, and I am a little unclear on a few points. In your article you mentioned a preamplifier which also serves to apply the required RIAA equalisation. What is RIAA equalisation?

You also mention a cut in the preamplifier tone control board to eliminate a troublesome earth loop. What trouble could an earth loop make? I have looked in quite a few books at school, but couldn't find either mentioned. I am hoping you can help me. Keep up the good magazine. The 143 is a superb amplifier. (J.K., Doncaster East, Vic.)

● Thank you for your comments about the magazine and the amplifier, J.K. An article explaining the why's and wherefore's of recording characteristics, titled "Disc Recordings—Then And Now" appeared in the May 1969 edition (File No. 8/AT/19). This should answer your queries about RIAA equalisation.

Your second question, concerning earth loops, is more difficult to answer. An article in the October 1972 edition entitled "That Annoying Hum ... and what to do about it" (File No. 8/AT/38) is a good place to start. In general, the term "earth loops" refers to any situation where hum is induced into the input of a device (usually an amplifier), by the action of currents flowing in a common impedance.

These currents can be induced by magnetic fields in conjunction with physical loops, as is the case in the October article, or they may be due to other currents, such as valve heater currents, flowing in paths not intended for them.

In the case of the PM 143, the cut you mention is necessary to prevent a possible earth loop inducing hum into the input of the magnetic pre-amplifier.

(Cont. on p. 107)

Low cost tacho for cars . . . from p49

that the lamp be used in this mode for long periods. The diode should be a power type with a reverse voltage rating of at least 800V.

50Hz corresponds to a crankshaft speed of 3000 rpm so at this speed, the vehicle timing pulley would appear stationary. Similarly, a check can be made at 1500 rpm by painting two white marks on the pulley (diametrically opposed). Four such marks will appear stationary at 750 rpm. Use the speed of 750 rpm to calibrate the 1000 rpm range. Just tweak the present pot until the meter reads correctly.

Finally, we should mention that this circuit can be adapted for use as a dash-mounted tachometer without any component changes other than to suit meter sensitivity, as mentioned above. As it stands, (with the .0082uF capacitor) the circuit is suitable for spark repetition rates up to 400Hz, which is equivalent to 6000 rpm for a V8, 8000 rpm in a 6-cylinder and 12,000 rpm in a 4-cylinder engine.

Calibration procedure is the same as before except that it should be optimised for readings at 1500 and 3000 rpm.

Happy tuning!

Optical/magnetic preamp . . . from p67

capacitor across each 15k resistor in the feedback path, and also the 6.8k resistor in series with the .0082uF shunt capacitor. Additional restriction of the frequency response is provided by the 22k resistor and .001uF capacitor in the output circuit.

The 1k resistor and 47pF capacitor in the input circuit are to provide suppression against RF interference.

The power requirement of the preamp is 18V DC at about 3.8mA. The supply should be well regulated and filtered.

The physical form of the preamp will depend upon the projector, of course, so that you will have to work this out for yourself. If you plan to fit it into a Bell and Howell machine of similar vintage to my own, you could build it in a form similar to that shown in the picture.

With this revised preamp circuit and the silicon photodiode provided with its optimum load resistance, the reproduction from most sound tracks can be very good indeed. However, with any "straight" preamp system like this, there is still a problem in obtaining acceptable reproduction with very poor tracks.

Of course there may well be some tracks which just cannot be reproduced satisfactorily. However, from work I have been doing lately, it seems possible to rescue most tracks if you are prepared to go into additional filtering and processing.

Quite a significant improvement can be gained with some films by using an adjustable sharp cutoff low pass filter. I will be describing such a filter in the next article.

10GHz link project—addendum

Following the article on our experimental 10GHz link system for radio amateurs in the September issue, Associated Controls Pty Ltd has advised that their microwave modules can now be purchased with the Gunn and detector diodes fitted in either polarity. The company also advises that they are prepared to set the transmitter frequency to any point within the range 9.5–11.5GHz, to an accuracy of plus/minus .03%, at no extra charge. This calibration service is available even for those who have already purchased uncalibrated Associated Controls modules. When ordering new modules, polarity and frequency should be specified.

MODIFIED 10 + 10's: A letter in the March Information Centre from P.L., Marigandau, QLD. regarding substituting AY8171/9171's caught my eye. I modified two 10 + 10 amps and used then in a unit based on your 4 channel PM140. The modifications were reasonably simple, but required a good deal of care and thought in redesign as the silicon types will not operate satisfactorily as "plug-in" replacements.

Three additional transistors were required, as well as changes to the bias and high frequency stability components. As a bonus, the supply voltage can be raised to 36 volts or more, giving a higher power output. The alterations are quite worthwhile, and do not cost a great amount. The additional parts can all be accommodated on the existing board.

I will be pleased to forward more specific details to any readers who may care to contact me. (L. E. Vivian, 11 Fram Street, Port Lincoln, SA 5606).

● Thank you for your letter Mr Vivian and, as you can see, we have published it for the benefit of interested readers.

TEMPERATURE CONTROL: In the March issue, J.R. of Nhill, Vic. asks about a precision temperature controller circuit. If you can arrange for him to contact me, I may be able to help him. (N. Luhrs, 19 Dundee Ave, Chadstone, Vic 3148).

● Thank you for your offer. As we have printed your name and address, we suggest that J.R. contact you direct.

Notes & Errata

CAPACITOR DISCHARGE IGNITION SYSTEM, July 1975, File No 3/TI/12: The supplementary positive chassis trigger diagram on page 50 contains an error in showing the SCR cathode connected to chassis. The diagram should be as shown below to agree with the positive chassis PC layout as on page 47 of the July article.

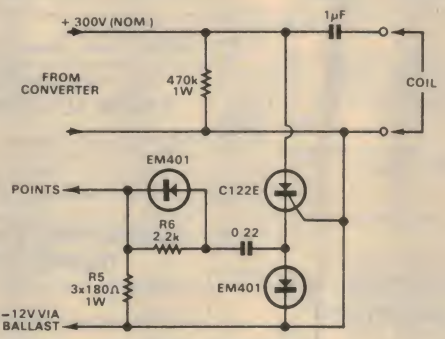
In addition, Plessey Ducon have advised that they do not consider the 3S10 oil-filled capacitor suitable for use in CDI systems. They recommend the 5S10A which has higher ratings.

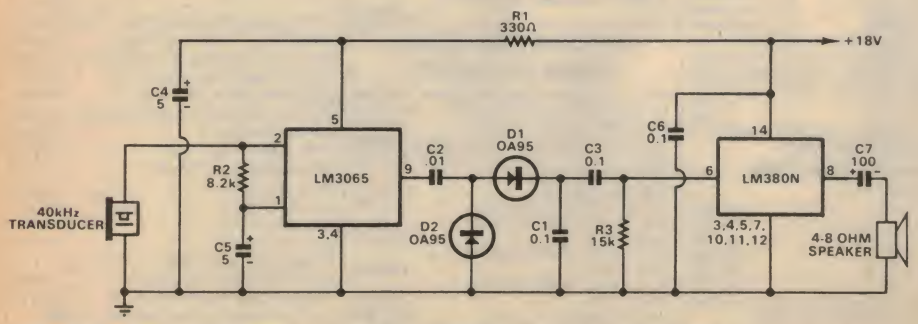
FM TUNER (July and August, 1975 File Nos. 2/TU/42,43): July, p42. Coil wire gauge should be 34B&S and not 22B&S. July, p41. The .027uF capacitor on the printed board should be .01uF. August, p39. Add resistors to parts list. 2 15k, 1 22k, 1 47k, 1 100k, 1 180k. August, p35. Mixer source resistor should be 270 ohms. July, p42. A small number of quadrature coils made by Jabel have been incorrectly terminated. Windings should be checked for continuity and if wrong, they may be readily changed by readers. Alternately, the makers will replace if required.

BWD ELECTRONICS: Due to a misunderstanding an incorrect price was shown in the advertisement for this firm in the July 1975 issue. We apologise for any inconvenience this may have caused.

EDUC-8 COMPUTER: On page 81 of December and page 36 of the handbook, the MA register contents after running the first test program should read 000, not 010. This is because the MA register is cleared at time T0 of the last (HALT) execute cycle.

There is also an error in the simple input keyboard unit. In Fig. 2 on page 67 of January 1975 (handbook p.40) there should be a direct connection between the SHIFT CLOCK (L) input and the CP input of the 7496 buffer register, not via an inverter. This inverter must also be disconnected on the PC board—it is the gate connecting to pins 8, 9 and 10 of the 7437. Failure to do this will cause loss of the LSB of all numbers. Corrected PC patterns have been sent to manufacturers.





ULTRASONIC DOPPLER ALARM (July 1975, File No. 3/MS/56): The LM1808 device used in the receiver has been in very limited supply. This circuit shows how to use an LM3065 and an LM380N for identical results.

Marketplace

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- Add tonearm of your choice.
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- Rumble: better than −50 dB (DIN A), −70 dB (DIN B).
- Fast build-up time (within ½ rotation at 33⅓ rpm).
- 33 cm aluminium diecast turntable platter, dynamically balanced.
- Stroboscope speed indication on tapered rim for easier checking.
- Variable pitch controls (±5%).
- Aluminium diecast base.
- Audio-insulated legs.
- Removable dust cover

SL 1200

SL 1200 STANDARD

- Direct-drive brushless DC motor.
- Wow & flutter: less than 0.03% WRMS.
- Rumble: better than −50 dB (DIN A), −70 dB (DIN B).
- Fast build-up time (within ½ rotation at 33⅓ rpm).
- 33 cm aluminium diecast turntable platter, dynamically balanced.
- Stroboscope speed indication on tapered rim for easier checking.
- Variable pitch controls (±5%).
- Precision-engineered tonearm with lateral balance and direct read-out of tracking force.
- Anti-skating device.
- Adaptable for discrete 4-channel (CD-4) records.
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- Audio-insulated legs.
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SL 1300 AUTOMATIC

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- Pitch control range 10%.
- 33 cm dynamically balanced platter.
- Stroboscope speed indication on tapered rim for easier checking.
- Precision engineered tonearm with gimbal suspension, "S"-shaped tubular, universal 4 pin connector, direct read out stylus pressure.
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- Adaptable for CD4 records.
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